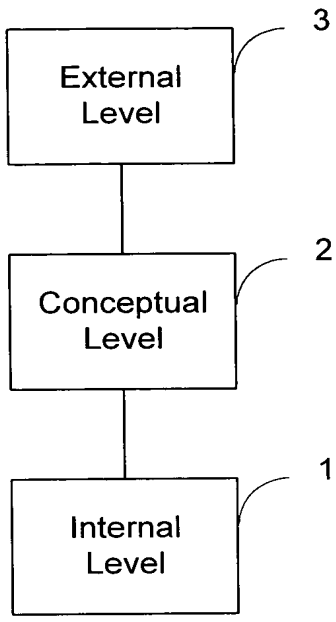

External Level
3
Conceptual Level
2
Internal Level
1

Fig. 1

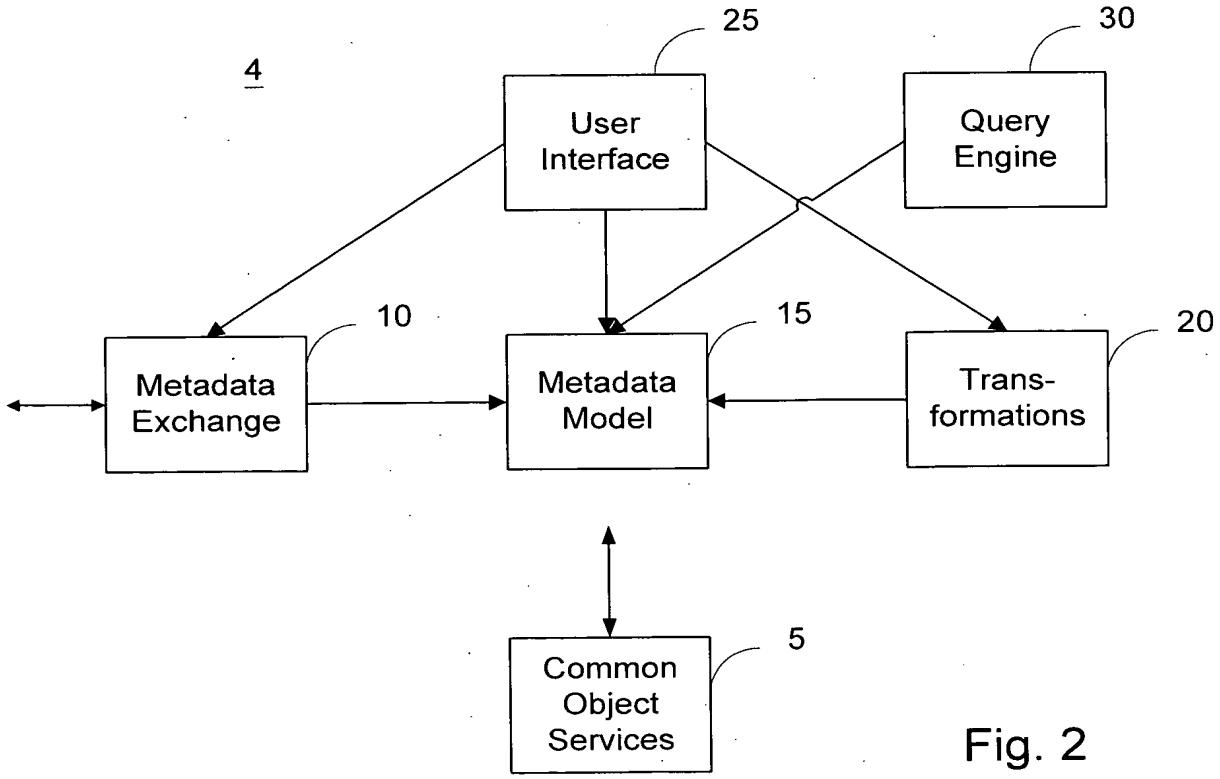

4
User Interface
25
Query Engine
30
Metadata Exchange
10
Metadata Model
15
Trans-formations
20
Common Object Services
5

Fig. 2

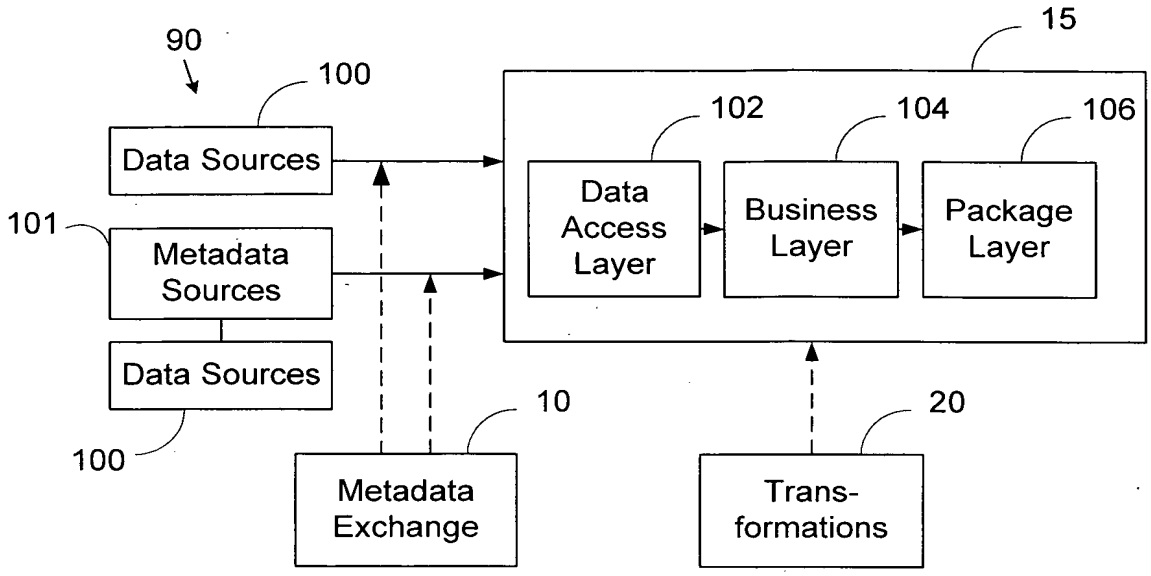

90
100
15
Data Sources
101
Metadata Sources
Data Sources
100
102
104
106
Data Access Layer
Business Layer
Package Layer
10
20
Metadata Exchange
Trans-formations

Fig. 2A

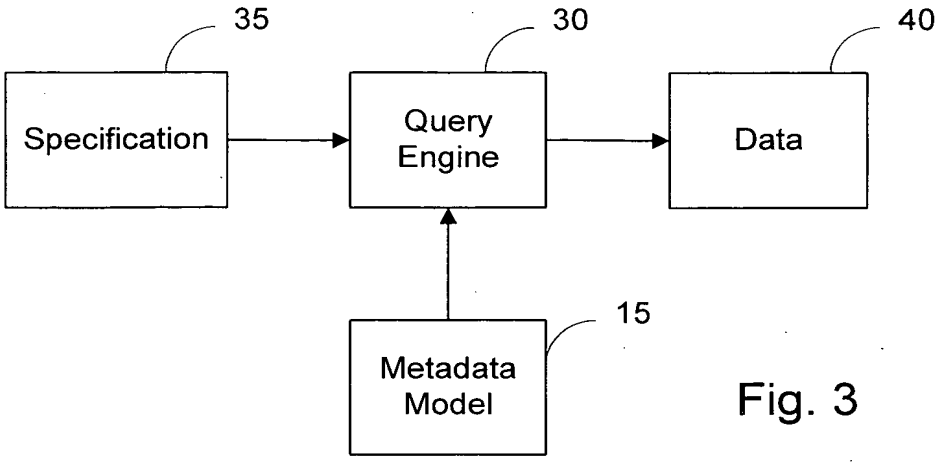

35
30
40
Specification
Query Engine
Data
15
Metadata Model

Fig. 3

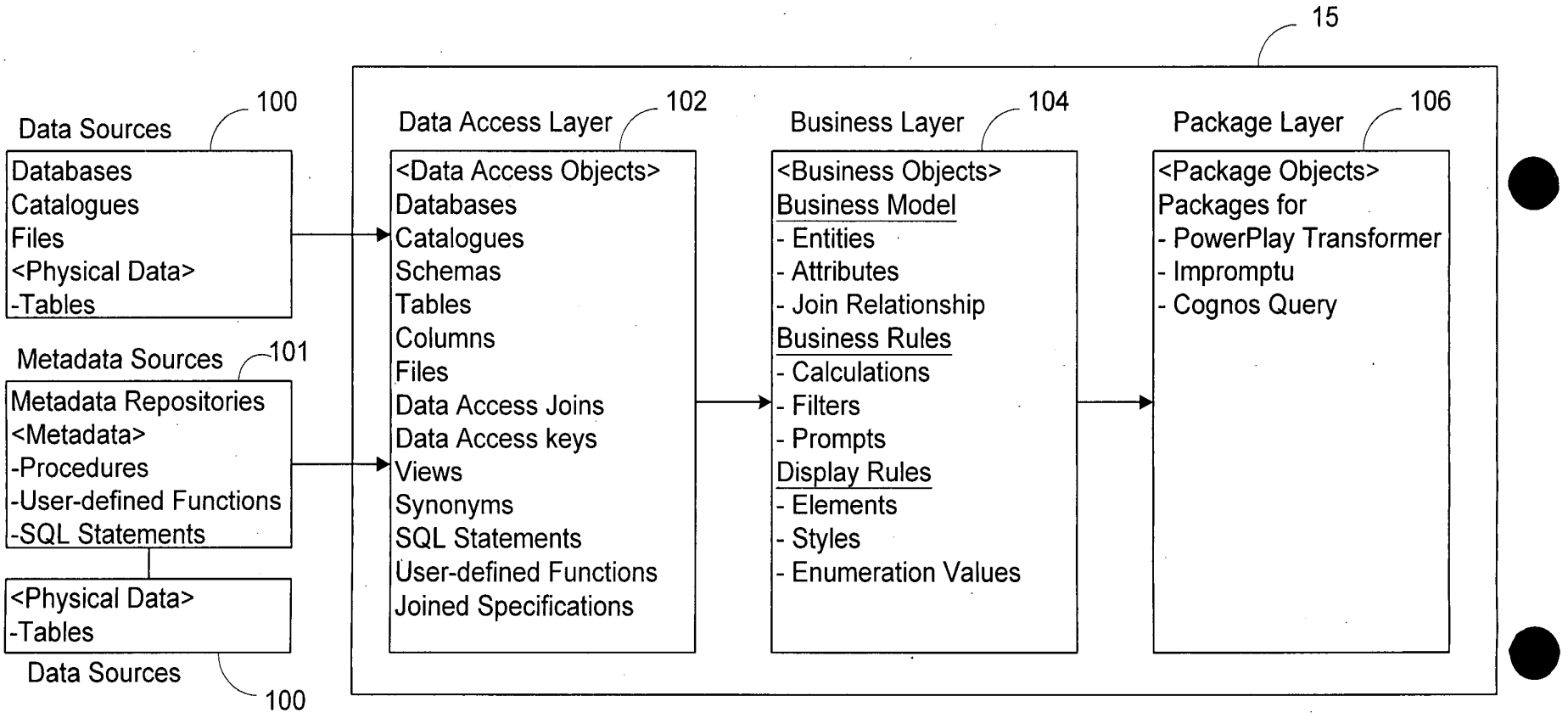

15
Data Sources
100
Databases
Catalogues
Files
<Physical Data>
-Tables
Metadata Sources
101
Metadata Repositories
<Metadata>
-Procedures
-User-defined Functions
-SQL Statements
<Physical Data>
-Tables
Data Sources
100
Data Access Layer
102
<Data Access Objects>
Databases
Catalogues
Schemas
Tables
Columns
Files
Data Access Joins
Data Access keys
Views
Synonyms
SQL Statements
User-defined Functions
Joined Specifications
Business Layer
104
<Business Objects>
Business Model
- Entities
- Attributes
- Join Relationship
Business Rules
- Calculations
- Filters
- Prompts
Display Rules
- Elements
- Styles
- Enumeration Values
Package Layer
106
<Package Objects>
Packages for
- PowerPlay Transformer
- Impromptu
- Cognos Query

Fig. 2B

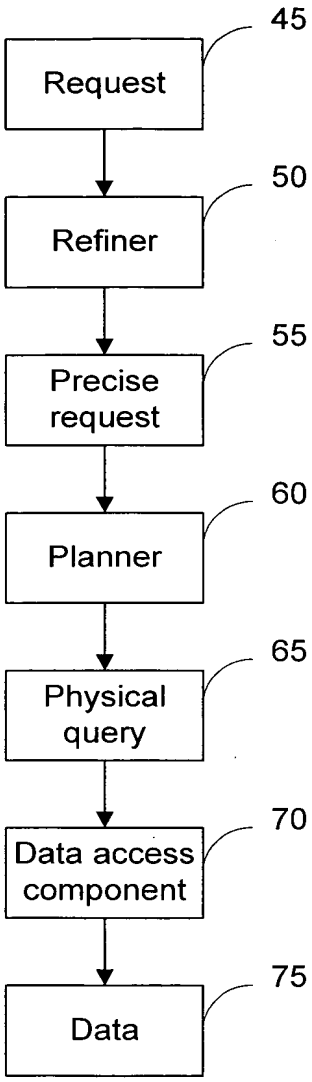

45
Request
50
Refiner
55
Precise request
60
Planner
65
Physical query
70
Data access component
75
Data

Fig. 4

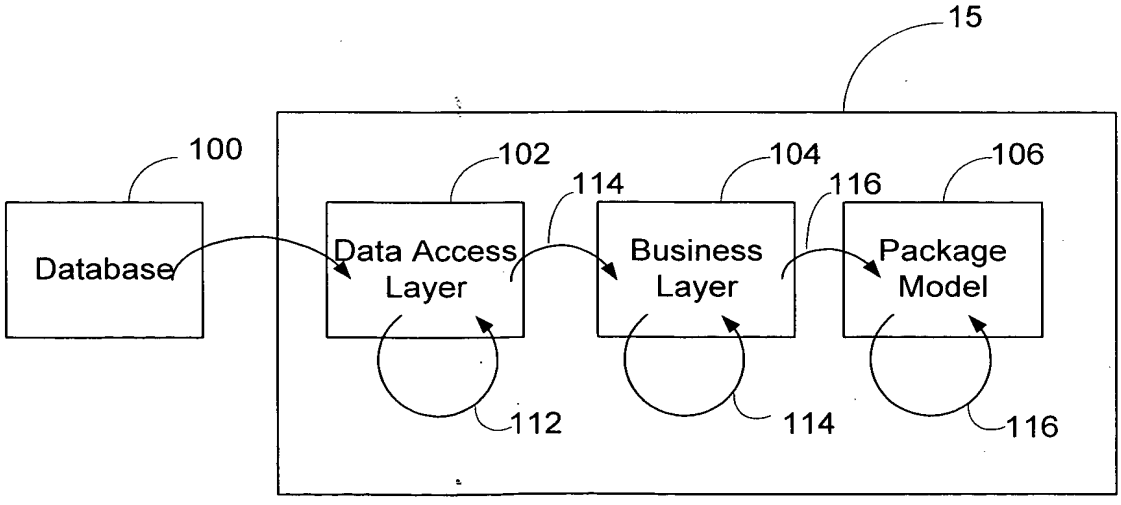

15
100
Database
102
Data Access Layer
114
104
Business Layer
116
106
Package Model
112
114
116

Fig. 4A

Data Access Model Transformations 112

112a	Data Access Join Constructing Transformation
112b	Data Access Key Constructing Transformation
112c	Table Extract Constructing Transformation
112d	Data Access Cube Constructing Transformation

Business Model Transformations 114

114a	Basic Business Model Constructing Transformation
114b	Many to Many Join Relationship Fixing Transformation
114c	Entity Coalescing Transformation
114d	Redundant Join Relationship Eliminating Transformation
114e	Subclass Relationship Introducing Transformation
114f	Entity Referencing Transformation
114g	Attribute Usage Determining Transformation
114h	Date Usage Identifying Transformation

Multidimensional Model Transformations 115

115a	Measure Identifying and Measure Dimension Constructing Transformation
115b	Category Dimension and Level Constructing Transformation
115c	Logic Cube Constructing Transformation

Package Model Transformations 116

116a	Basic Package Model Constructing Transformation
116b	Package Constructing Transformation for Cognos Query

General Transformations 117

117a	Name Mutation Transformation

Fig. 4B

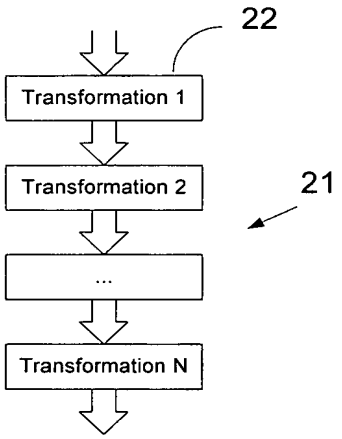

22
Transformation 1
Transformation 2
21
...
Transformation N

Fig. 5

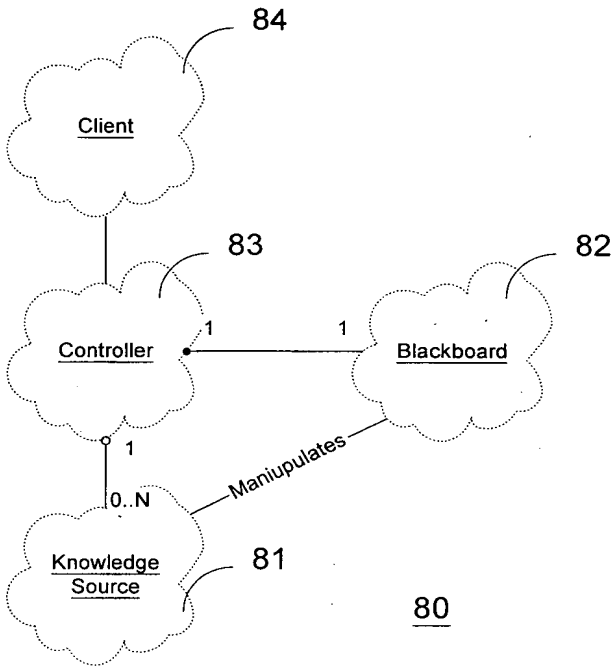

84
Client
83
82
Controller
1
1
Blackboard
1
Maniupulates
0..N
Knowledge Source
81
80

Fig. 6

Prohibit	Object Processed	Parent Relationship Processed	Parent Action	Child Relationship Processed	Child Action
Yes	Don't Care	Don't Care	Nothing	Don't Care	Nothing
No	No	Doesn't Exist	Create new target object and relationship. Mark object and relationship as processed after processing children.		
		No	Mark object and relationship as processed after processing children.		
				Doesn't Exist	Create new target object and relationship. Mark object and relationship as processed.
				No	Mark relationship as processed
				Yes	Nothing
		Yes	Process children.		
				Doesn't Exist	Create new target object and relationship. Mark object and relationship as processed.
				No	Mark relationship as processed
				Yes	Nothing
	Yes	Doesn't Exist	Nothing		
		No	Mark object and relationship as processed after processing children.		
				Doesn't Exist	Create new target object and relationship. Mark object and relationship as processed.
				No	Mark relationship as processed
				Yes	Nothing
		Yes	Process children.		
				Doesn't Exist	Nothing
				No	Mark relationship as processed
				Yes	Nothing

Fig. 7

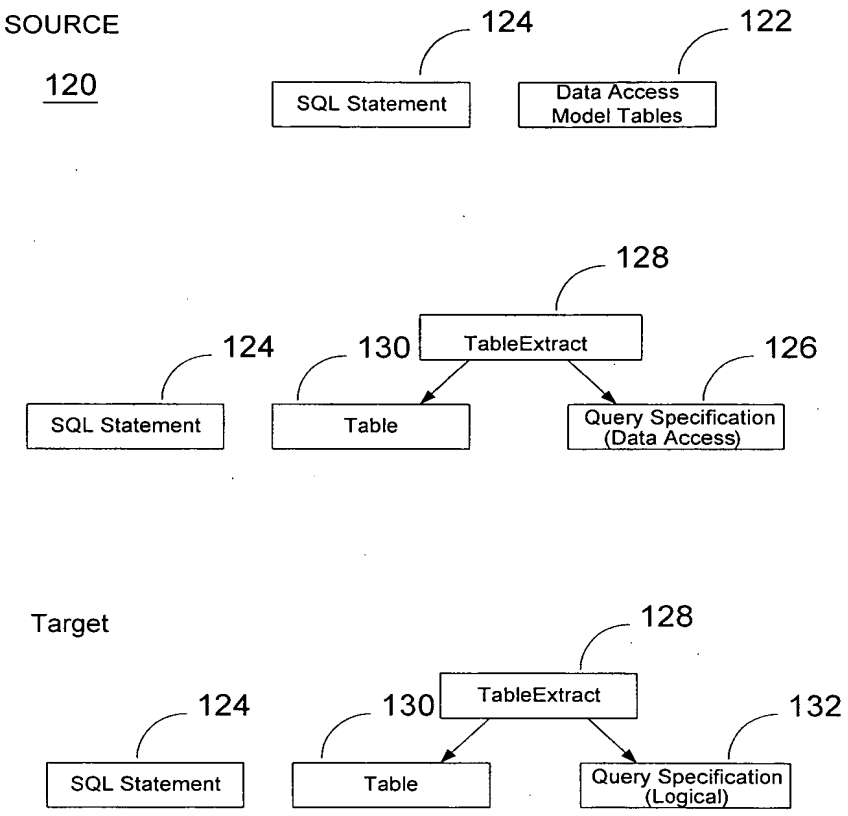

SOURCE
120
124
122
SQL Statement
Data Access Model Tables
128
124
130
TableExtract
126
SQL Statement
Table
Query Specification (Data Access)
Target
128
124
130
TableExtract
132
SQL Statement
Table
Query Specification (Logical)

Fig. 8

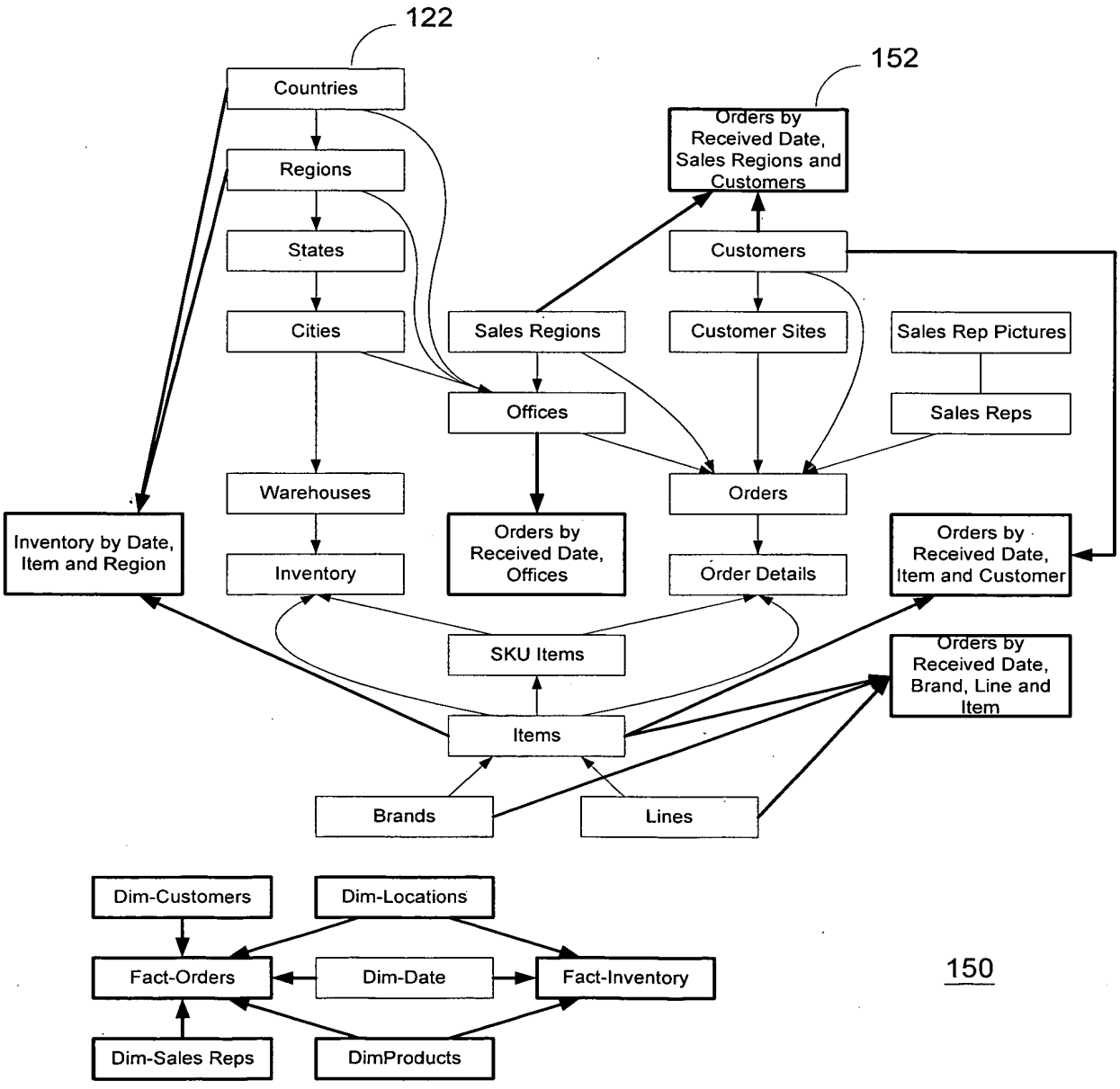

122
152
Countries
Regions
States
Cities
Warehouses
Inventory
Orders by Received Date, Sales Regions and Customers
Customers
Sales Regions
Customer Sites
Sales Rep Pictures
Offices
Sales Reps
Orders
Inventory by Date, Item and Region
Orders by Received Date, Offices
Order Details
Orders by Received Date, Item and Customer
SKU Items
Orders by Received Date, Brand, Line and Item
Items
Brands
Lines
Dim-Customers
Dim-Locations
Fact-Orders
Dim-Date
Fact-Inventory
Dim-Sales Reps
DimProducts
150

Fig. 9

	Segment Name	Brand #	City #	Country #	Customer #	Date	Item #	Line #	Office #	Order #	Order Line #	Received Date	Region #	Sales Region #	Sales Rep #	Site #	SKU #	State #	Warehouse #
Table Name		5	4	8	6	4	7	5	4	2	1	5	7	4	4	3	5	5	4
Brands	1	1																	
Cities	4		1	1									1					1	
Countries	1			1															
Customers	1				1														
Customer Sites	2				1											1			
Inventory	3					1											1		1
Inventory by Date, Item, Region	4			1		1	1						1						
Items	1						1												
Lines	1							1											
Offices	1								1										
Orders	1									1									
Orders by Received Date, Brand, Line and Item	4	1					1	1				1							
Orders by Received Date, Item, Customer	3				1		1					1							
Orders by Received Date, Office	2								1			1							
Orders by Received Date, Sales Region, Customer	3				1							1		1					
Order Details	2									1	1								
Regions	2			1									1						
Sales Regions	1													1					
Sales Rep Pictures	1														1				
Sales Reps	1														1				
SKU Items	1																1		
States	3			1									1					1	
Warehouses	1																		1
Dim-Locations	7		1	1					1				1	1				1	1
Dim-Products	4	1					1	1									1		
Dim-Customers	2				1											1			
Dim-Sales Reps	1														1				
Dim-Date	1					1													
Fact-Orders	14	1	1	1	1		1	1	1			1	1	1	1	1	1	1	
Fact-Inventory	10	1	1	1		1	1	1					1				1	1	1

Fig. 10

	Segment Name	Brand #	City #	Country #	Customer #	Date	Item #	Line #	Office #	Order #	Order Line #	Received Date	Region #	Sales Region #	Sales Rep #	Site #	SKU #	State #	Warehouse #
Table Name		11	10	14	8	4	10	11	6	2	1	5	13	8	6	5	6	11	4
Brands	1	1																	
Cities	4		1	1									1					1	
Countries	1			1															
Customers	1				1														
Customer Sites	2				1											1			
Inventory	10	1	1	1		1	1	1					1				1	1	1
Inventory by Date, Item, Region	6	1		1		1	1	1					1						
Items	3	1					1	1											
Lines	1							1											
Offices	6		1	1					1				1	1				1	
Orders	10		1	1	1				1	1			1	1	1	1		1	
Orders by Received Date, Brand, Line and Item	4	1					1	1				1							
Orders by Received Date, Item, Customer	5	1			1		1	1				1							
Orders by Received Date, Office	7		1	1					1			1	1	1				1	
Orders by Received Date, Sales Region, Customer	3				1							1		1					
Order Details	15	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1	
Regions	2			1									1						
Sales Regions	1													1					
Sales Rep Pictures	1														1				
Sales Reps	1														1				
SKU Items	4	1					1	1									1		
States	3			1									1					1	
Warehouses	5		1	1									1					1	1
Dim-Locations	7		1	1					1				1	1				1	1
Dim-Products	4	1					1	1									1		
Dim-Customers	2				1											1			
Dim-Sales Reps	1														1				
Dim-Date	1					1													
Fact-Orders	14	1	1	1	1		1	1	1			1	1	1	1	1	1	1	
Fact-Inventory	10	1	1	1		1	1	1					1				1	1	1

Fig. 11

	Segment Name	Brand #	City #	Country #	Customer #	Date	Item #	Line #	Office #	Order #	Order Line #	Received Date	Region #	Sales Region #	Sales Rep #	Site #	SKU #	State #	Warehouse #
Table Name		11	10	14	8	4	10	11	6	2	1	5	13	8	6	5	6	11	4
Order Details	15	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1	
Fact-Orders	14	1	1	1	1		1	1	1			1	1	1	1	1	1	1	
Inventory	10	1	1	1		1	1	1					1				1	1	1
Orders	10		1	1	1				1	1			1	1	1	1		1	
Fact-Inventory	10	1	1	1		1	1	1					1				1	1	1
Orders by Received Date, Office	7		1	1					1			1	1	1				1	
Dim-Locations	7		1	1					1				1	1				1	1
Inventory by Date, Item, Region	6	1		1		1	1	1					1						
Offices	6		1	1					1				1	1				1	
Orders by Received Date, Item, Customer	5	1			1		1	1				1							
Warehouses	5		1	1									1					1	1
Cities	4		1	1									1					1	
Orders by Received Date, Brand, Line and Item	4	1					1	1				1							
SKU Items	4	1					1	1									1		
Dim-Products	4	1					1	1									1		
Items	3	1					1	1											
Orders by Received Date, Sales Region, Customer	3				1							1		1					
States	3			1									1					1	
Customer Sites	2				1											1			
Regions	2			1									1						
Dim-Customers	2				1											1			
Brands	1	1																	
Countries	1			1															
Customers	1				1														
Lines	1							1											
Sales Regions	1													1					
Sales Rep Pictures	1														1				
Sales Reps	1														1				
Dim-Sales Reps	1														1				
Dim-Date	1					1													

Fig. 12

	Segment Name	Brand #	City #	Country #	Customer #	Date	Item #	Line #	Office #	Order #	Order Line #	Received Date	Region #	Sales Region #	Sales Rep #	Site #	SKU #	State #	Warehouse #
Order Details	15	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1	
Fact-Orders	14	1	1	1	1		1	1	1			1	1	1	1	1	1	1	

Fig. 13

	Segment Name	Brand #	City #	Country #	Customer #	Date	Item #	Line #	Office #	Order #	Order Line #	Received Date	Region #	Sales Region #	Sales Rep #	Site #	SKU #	State #	Warehouse #
Order Details	15	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1	
Inventory	10	1	1	1		1	1	1					1				1	1	1

Fig. 14

	Segment Name	Brand #	City #	Country #	Customer #	Date	Item #	Line #	Office #	Order #	Order Line #	Received Date	Region #	Sales Region #	Sales Rep #	Site #	SKU #	State #	Warehouse #
Table Name		5	4	8	6	4	7	5	4	2	1	5	7	4	4	3	5	5	4
Brands	1	1																	
Cities	4		1	1									1					1	
Countries	1			1															
Customers	1				1														
Customer Sites	2				1											1			
Inventory	3					1											1		1
Inventory by Date, Item, Region	4			1		1	1						1						
Items	1						1												
Lines	1							1											
Offices	1								1										
Orders	1									1									
Orders by Received Date, Brand, Line and Item	4	1					1	1				1							
Orders by Received Date, Item, Customer	3				1		1					1							
Orders by Received Date, Office	2								1			1							
Orders by Received Date, Sales Region, Customer	3				1							1		1					
Order Details	2									1	1								
Regions	2			1									1						
Sales Regions	1													1					
Sales Rep Pictures	1														1				
Sales Reps	1														1				
SKU Items	1																1		
States	3			1									1					1	
Warehouses	1																		1
Dim-Locations	7		1	1					1				1	1				1	1
Dim-Products	4	1					1	1									1		
Dim-Customers	2				1											1			
Dim-Sales Reps	1														1				
Dim-Date	1					1													
Fact-Orders	14	1	1	1	1		1	1	1			1	1	1	1	1	1	1	
Fact-Inventory	10	1	1	1		1	1	1					1				1	1	1

Fig. 15

Table	Attributes
Brands	**Brand #**
Cities	**Country #**, **Region #**, **State #**, **City #**
Countries	**Country #**
Customers	**Customer #**
Customer Sites	**Customer #**, **Site #**
Dim-Customers	**Customer #**, **Site #**
Dim-Date	**Date**, Day-of-Month, Day-of-Week, Holiday, Quarter #, Week #
Dim-Locations	**Country #**, **Region #**, **State #**, **City #**, **Warehouse #**, **Office #**, **Sales Region #**
Dim-Products	**Brand #**, **Line #**, **Item #**, **SKU #**
Dim-Sales Reps	**Sales Rep #**
Fact-Inventory	**Date**, **Country #**, **Region #**, **State #**, **City #**, **Warehouse #**, **Brand #**, **Line #**, **Item #**, **SKU #**, Quantity on Hand
Fact-Orders	**Customer #**, **Site #**, **Date**, **Country #**, **Region #**, **State #**, **City #**, **Office #**, **Sales Region #**, **Brand #**, **Line #**, **Item #**, **SKU #**, **Sales Rep #**, Units, Cost
Inventory	**Warehouse #**, **SKU #**, **Date**, Quantity on Hand
Inventory by Date, Item and Region	**Country #**, **Region #**, **Item #**, **Date**, Quantity on Hand
Items	Brand #, Line #, **Item #**
Lines	**Line #**
Offices	Country #, Region #, State #, City #, **Office #**, Sales Region #
Orders	**Order #**, Sales Rep #, Customer #, Site #, Office #, Received Date
Orders by Received Date, Brand, Line, and Item	**Received Date**, **Brand #**, **Line #**, **Item #**, Units, Cost
Orders by Received Date, Item and Customer	**Received Date**, **Item #**, **Customer #**, Units, Cost
Orders by Received Date, Offices	**Received Date**, **Office #**, Cost
Orders by Received Date, Sales Regions and Customers	**Received Date**, **Sales Region #**, **Customer #**, Cost
Order Details	**Order #**, **Order Line #**, SKU #, Units, Cost
Regions	**Country #**, **Region #**
Sales Regions	**Sales Region #**
Sales Rep Pictures	**Sales Rep #**
Sales Reps	**Sales Rep #**
SKU Items	Item #, **SKU #**, Colour, Size
States	**Country #**, **Region #**, **State #**
Warehouses	Country #, Region #, State #, City #, **Warehouse #**

Oracle-2005

Fig. 16

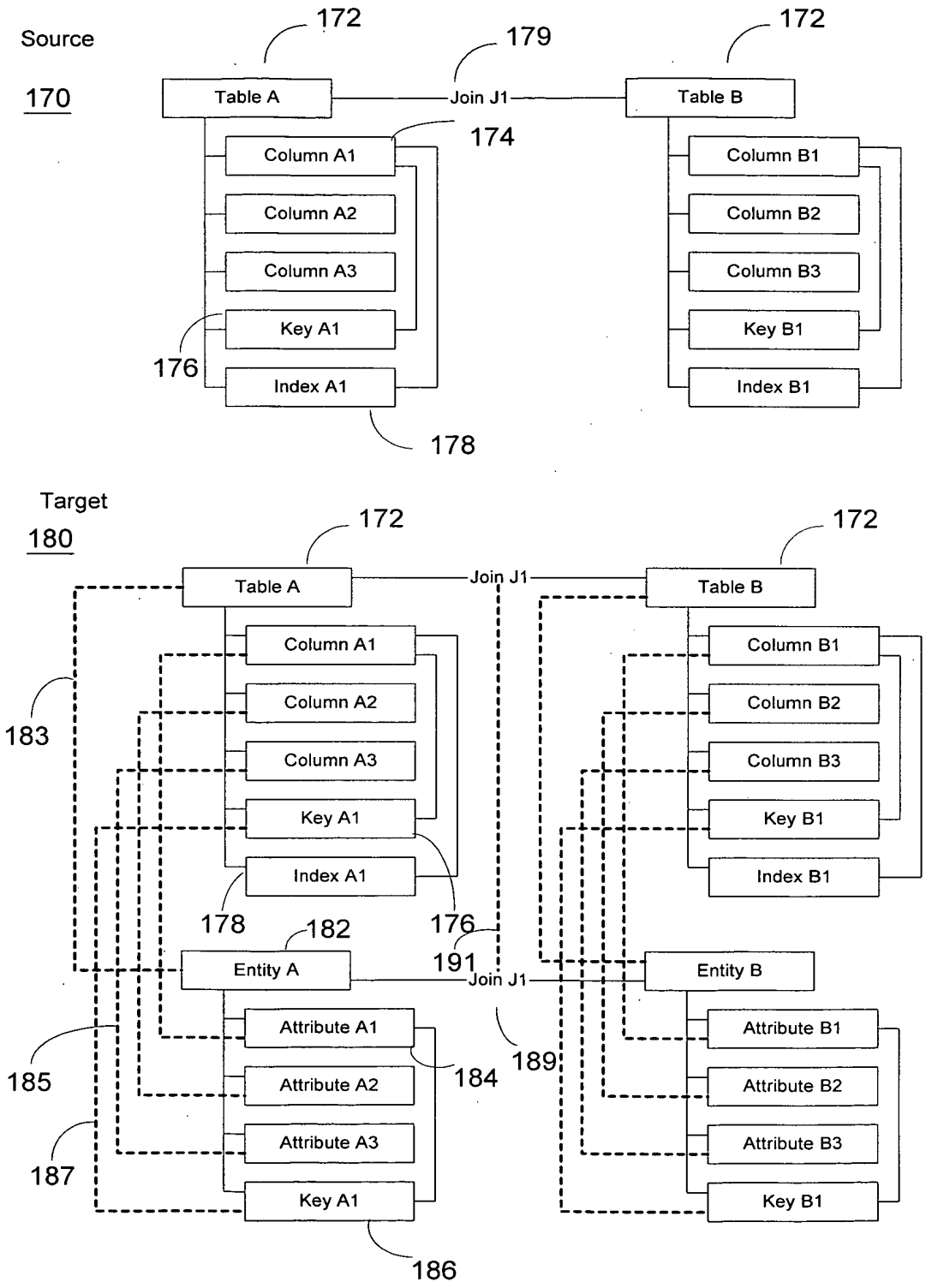
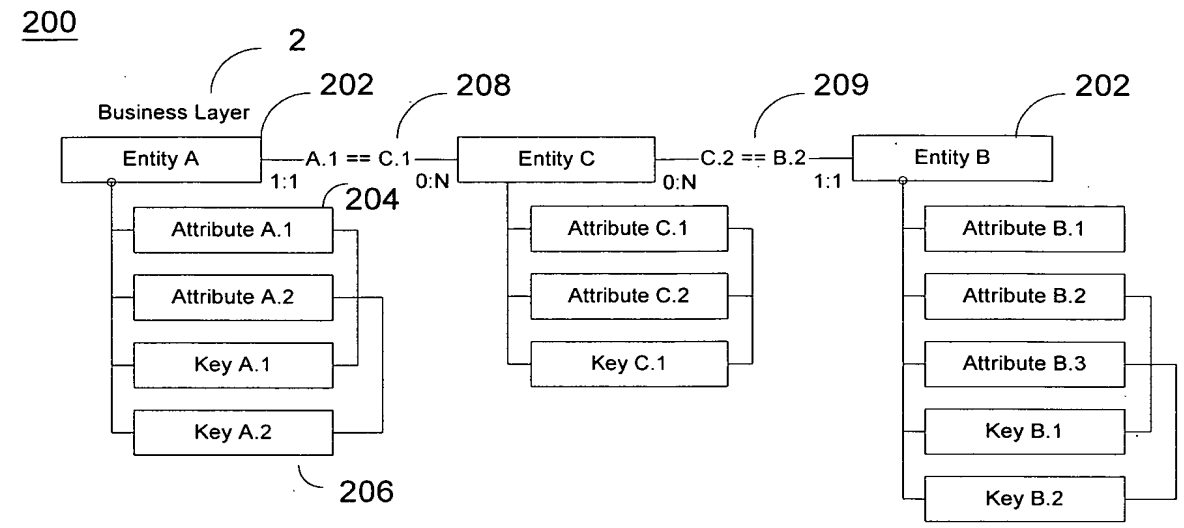

Source
170
172
179
172
Table A
Join J1
Table B
174
Column A1
Column A2
Column A3
Key A1
Index A1
Column B1
Column B2
Column B3
Key B1
Index B1
176
178
Target
180
172
172
Table A
Join J1
Table B
Column A1
Column A2
Column A3
Key A1
Index A1
Column B1
Column B2
Column B3
Key B1
Index B1
183
178
176
182
191
Entity A
Join J1
Entity B
Attribute A1
Attribute A2
Attribute A3
Key A1
Attribute B1
Attribute B2
Attribute B3
Key B1
185
184
189
187
186

Fig. 17

Doc ID: US 2005/0060324 A1

Source 1



Target 1

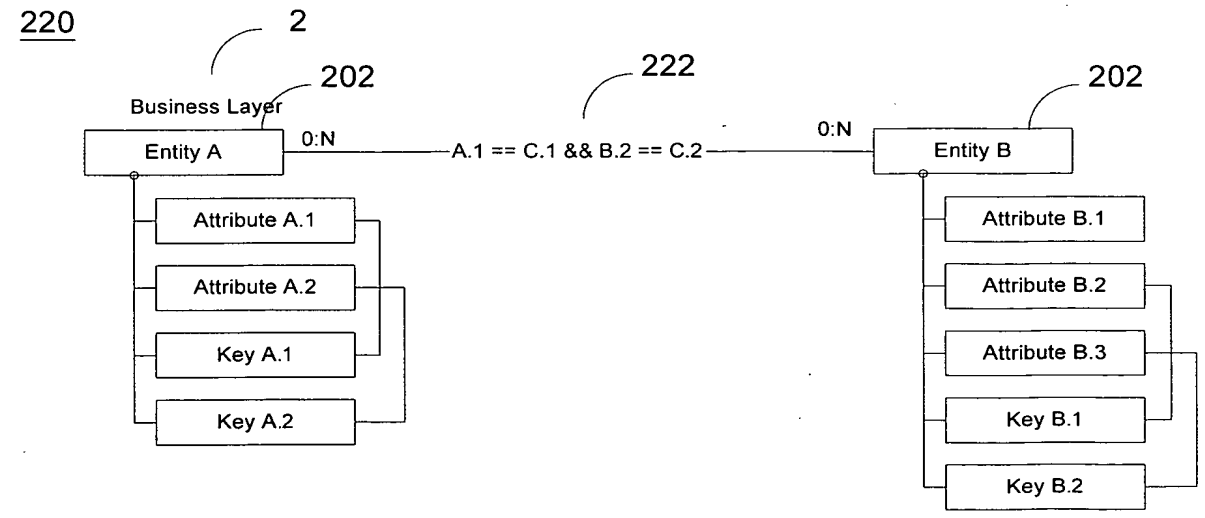


Fig. 18

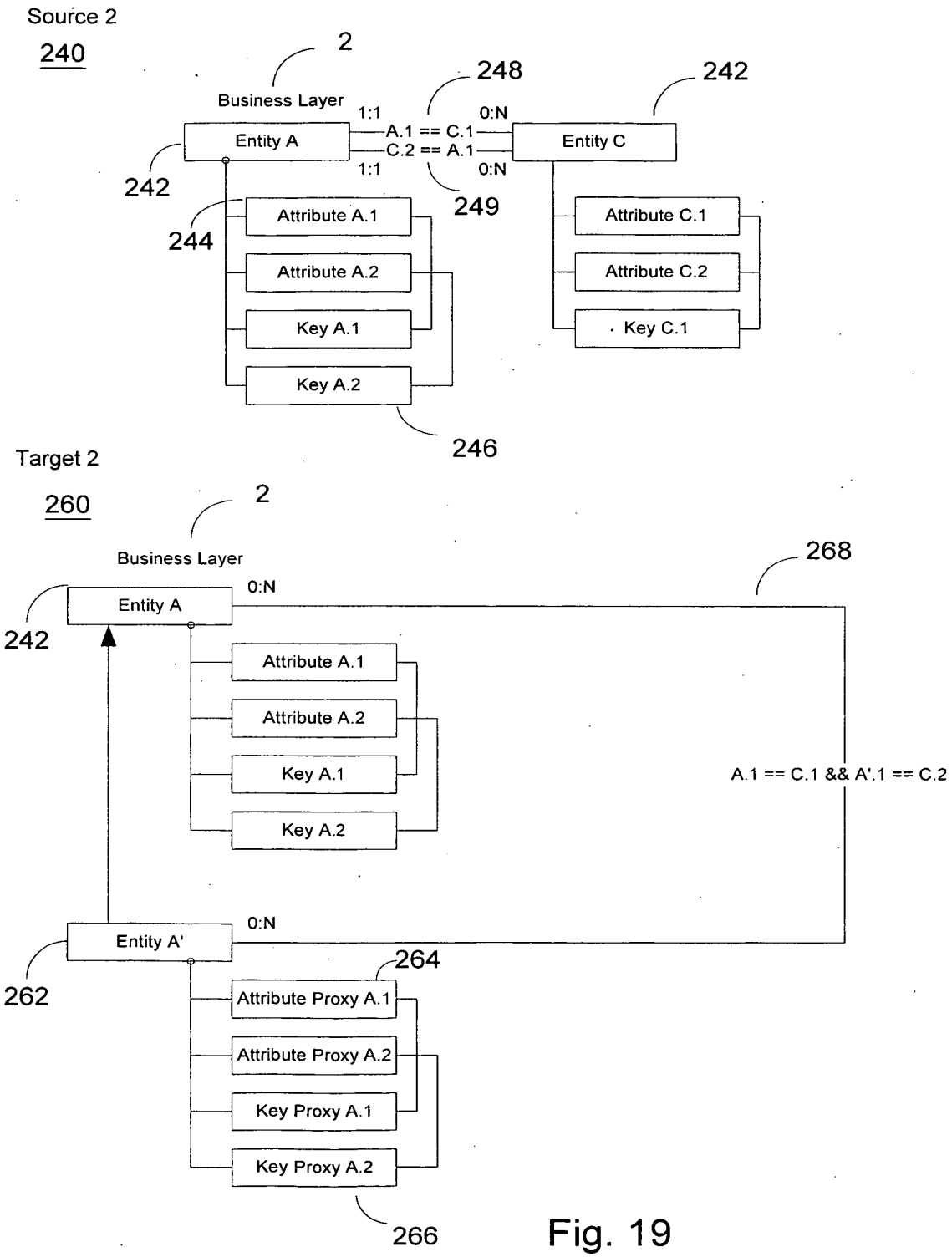

Source 2
240
2
Business Layer
248
242
1:1
0:N
Entity A
A.1 == C.1
C.2 == A.1
Entity C
1:1
0:N
242
249
244
Attribute A.1
Attribute A.2
Key A.1
Key A.2
Attribute C.1
Attribute C.2
Key C.1
246
Target 2
260
2
Business Layer
268
0:N
Entity A
242
Attribute A.1
Attribute A.2
Key A.1
Key A.2
A.1 == C.1 && A'.1 == C.2
0:N
Entity A'
262
264
Attribute Proxy A.1
Attribute Proxy A.2
Key Proxy A.1
Key Proxy A.2
266

Fig. 19

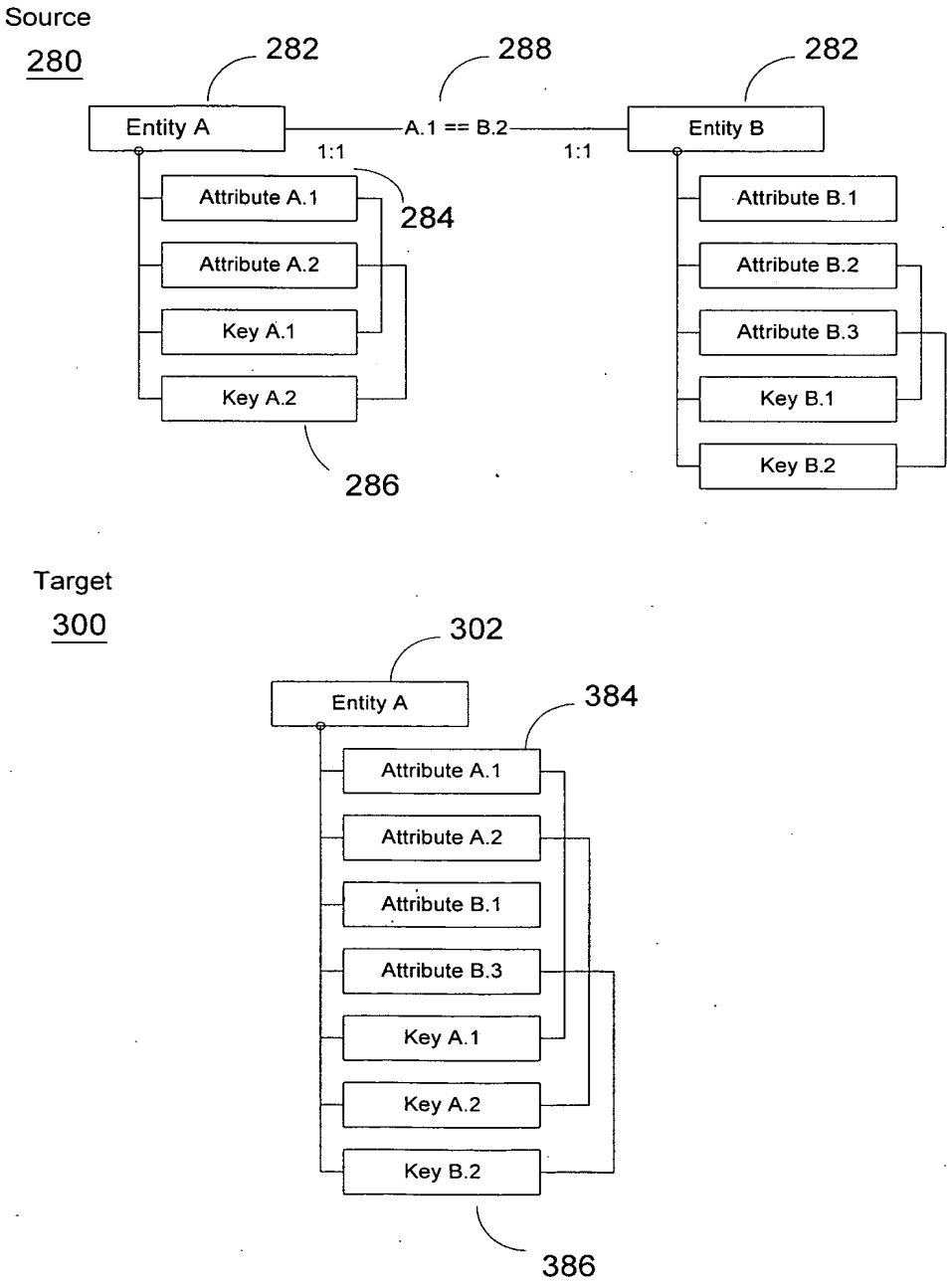

Source
280
282
288
282
Entity A
A.1 == B.2
Entity B
1:1
1:1
Attribute A.1
284
Attribute A.2
Key A.1
Key A.2
286
Attribute B.1
Attribute B.2
Attribute B.3
Key B.1
Key B.2
Target
300
302
Entity A
384
Attribute A.1
Attribute A.2
Attribute B.1
Attribute B.3
Key A.1
Key A.2
Key B.2
386

Fig. 20

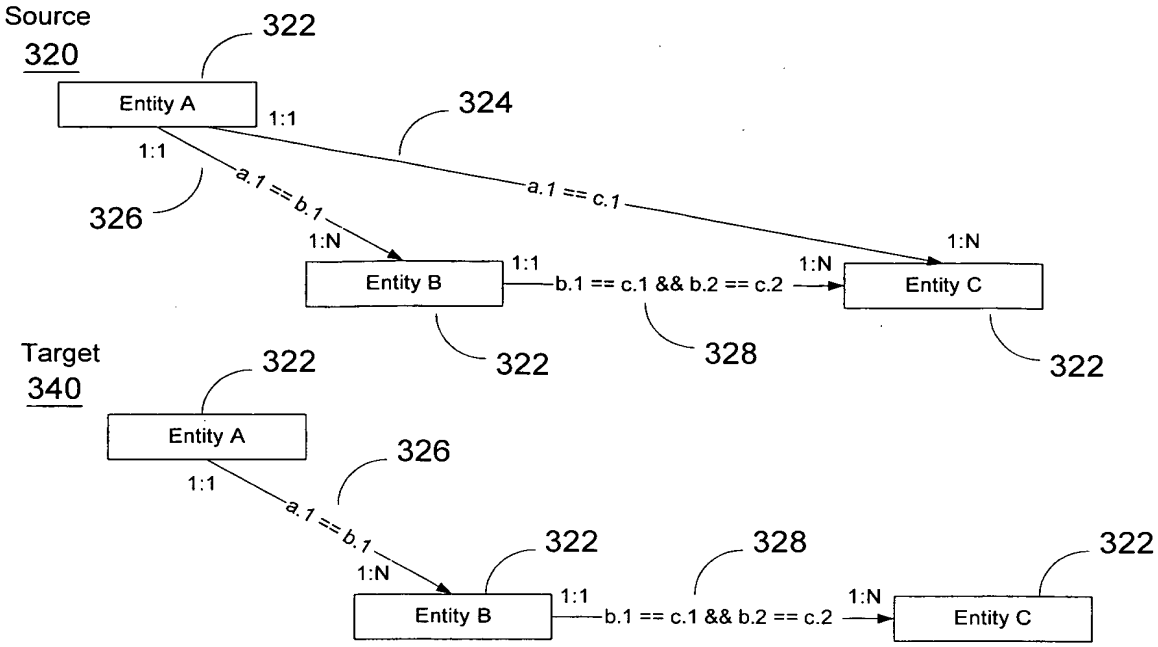

Source
320
322
Entity A
1:1
324
1:1
a.1 == c.1
326
a.1 == b.1
1:N
1:N
Entity B
1:1
b.1 == c.1 && b.2 == c.2
1:N
Entity C
322
328
322
Target
340
322
Entity A
326
1:1
a.1 == b.1
1:N
322
328
322
Entity B
1:1
b.1 == c.1 && b.2 == c.2
1:N
Entity C

Fig. 21

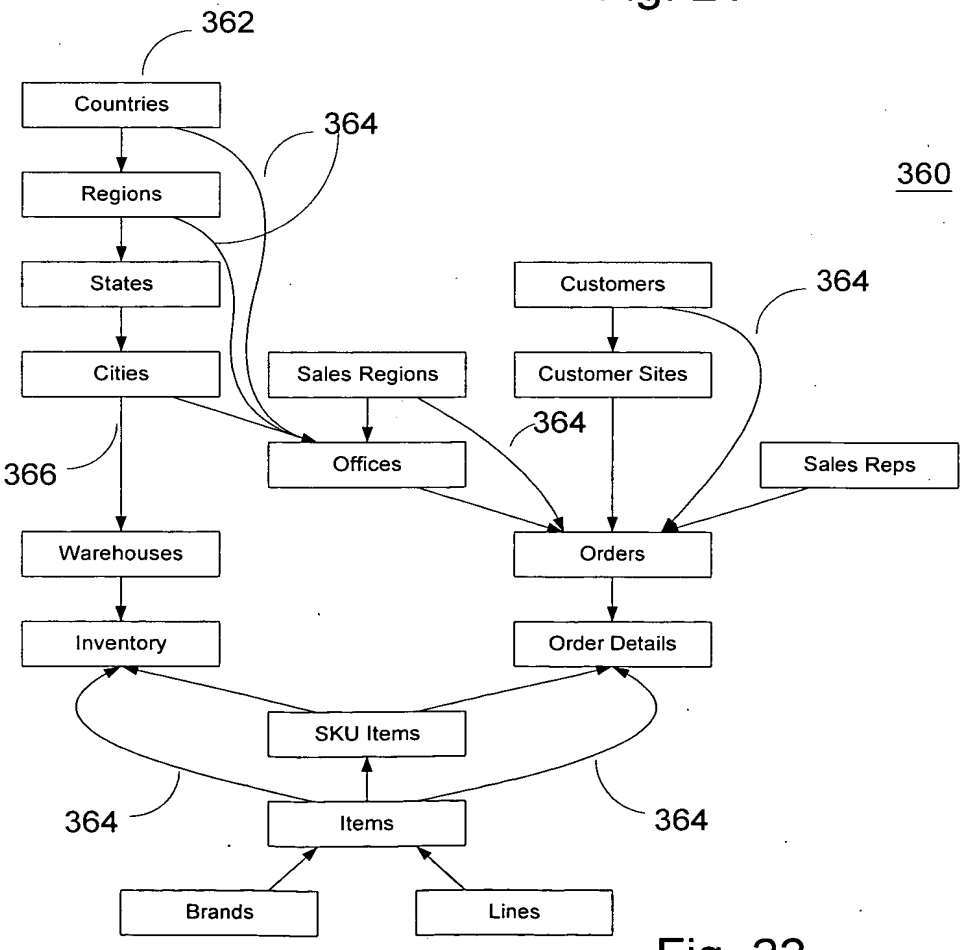

362
Countries
364
Regions
360
States
Customers
364
Cities
Sales Regions
Customer Sites
364
366
Offices
Sales Reps
Warehouses
Orders
Inventory
Order Details
SKU Items
364
364
Items
Brands
Lines

Fig. 22

370

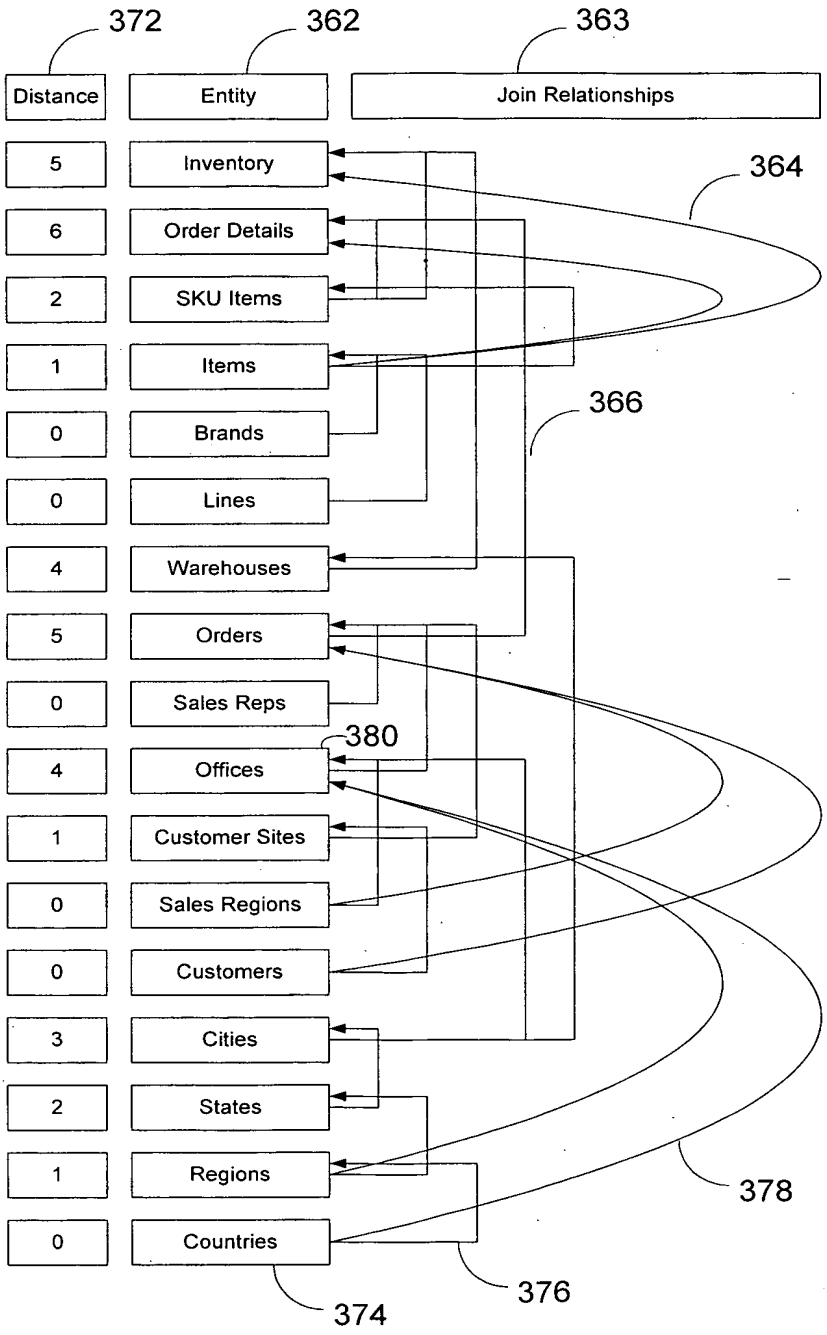

372
362
363
Distance
Entity
Join Relationships
5
Inventory
364
6
Order Details
2
SKU Items
1
Items
366
0
Brands
0
Lines
4
Warehouses
5
Orders
0
Sales Reps
380
4
Offices
1
Customer Sites
0
Sales Regions
0
Customers
3
Cities
2
States
1
Regions
378
0
Countries
376
374

Fig. 23

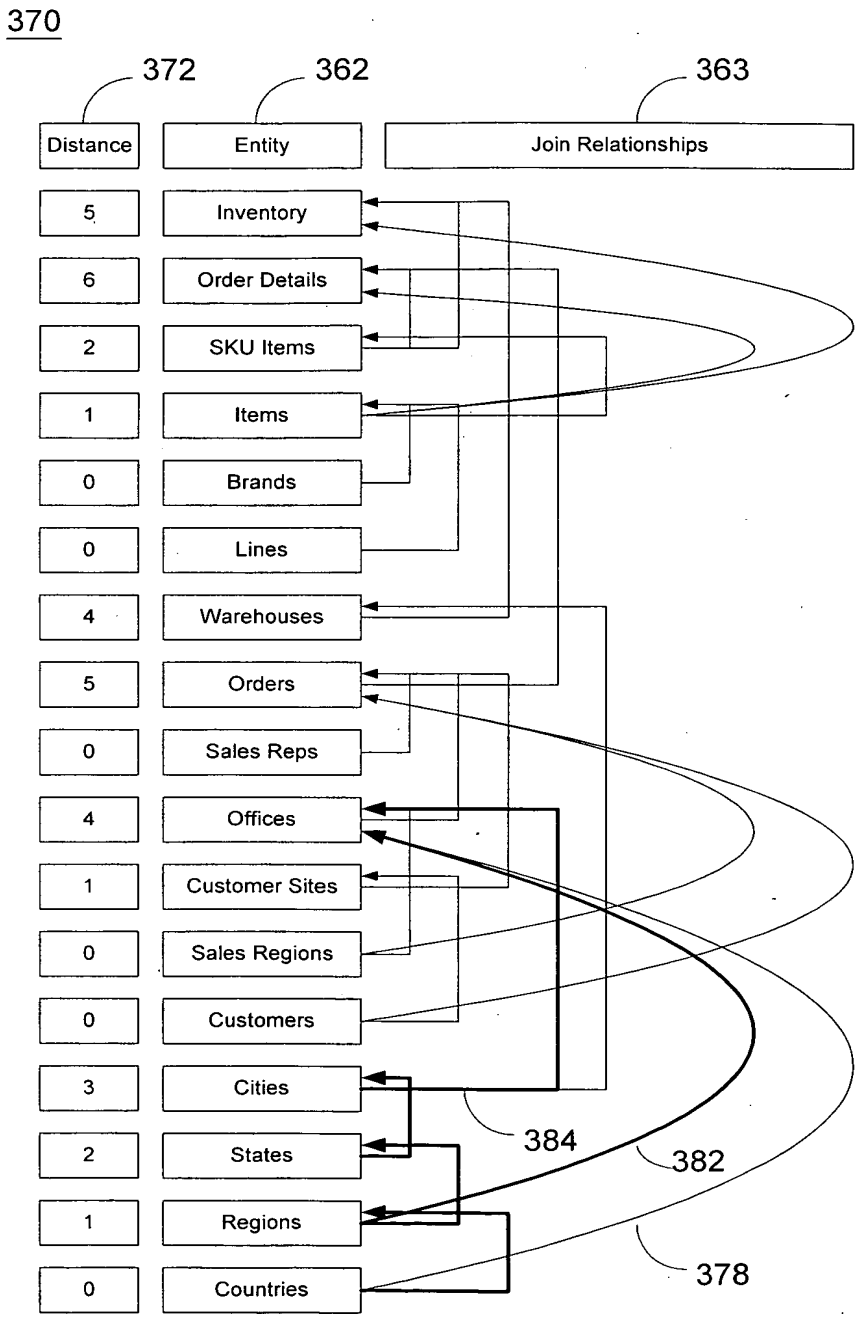

370
372
362
363
Distance
Entity
Join Relationships
5
Inventory
6
Order Details
2
SKU Items
1
Items
0
Brands
0
Lines
4
Warehouses
5
Orders
0
Sales Reps
4
Offices
1
Customer Sites
0
Sales Regions
0
Customers
3
Cities
2
States
1
Regions
0
Countries
384
382
378

Fig. 24

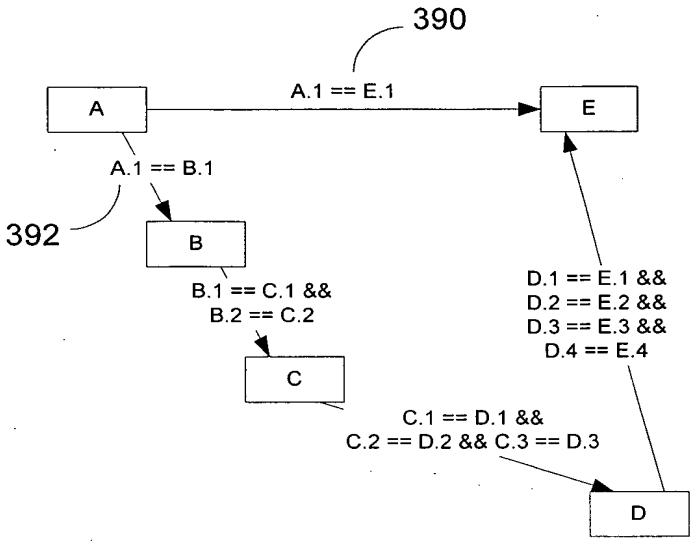
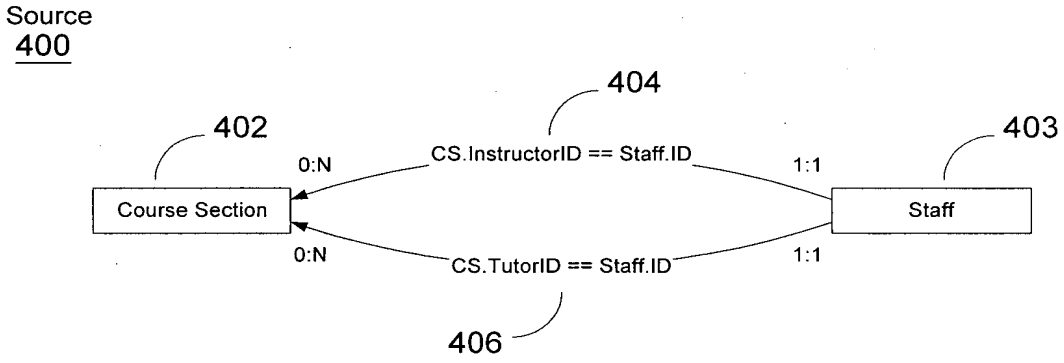


Fig. 25



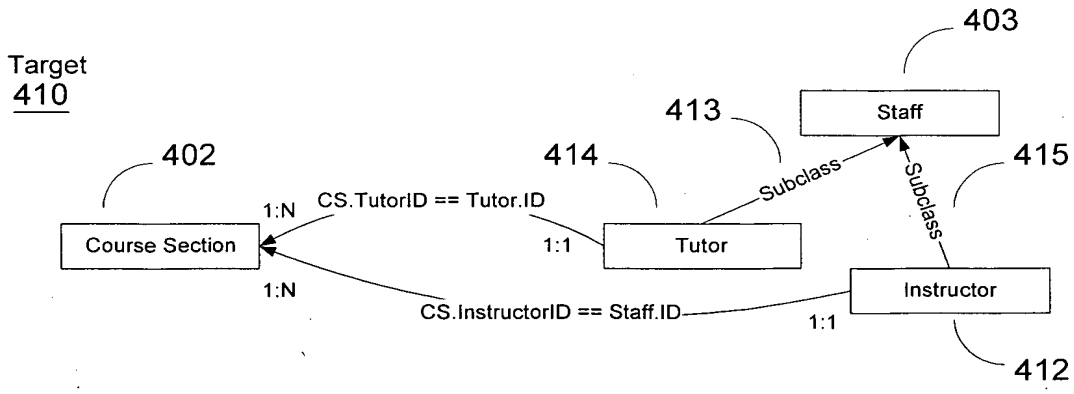


Fig. 26

Docket No. 60655.2700

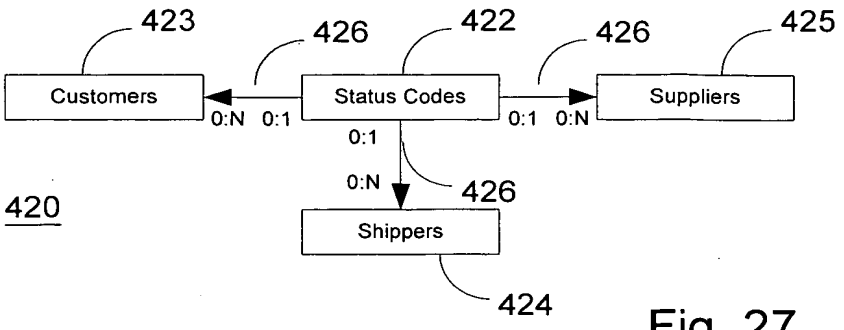

423
426
422
426
425
Customers
Status Codes
Suppliers
0:N
0:1
0:1
0:N
0:1
0:N
426
420
Shippers
424

Fig. 27

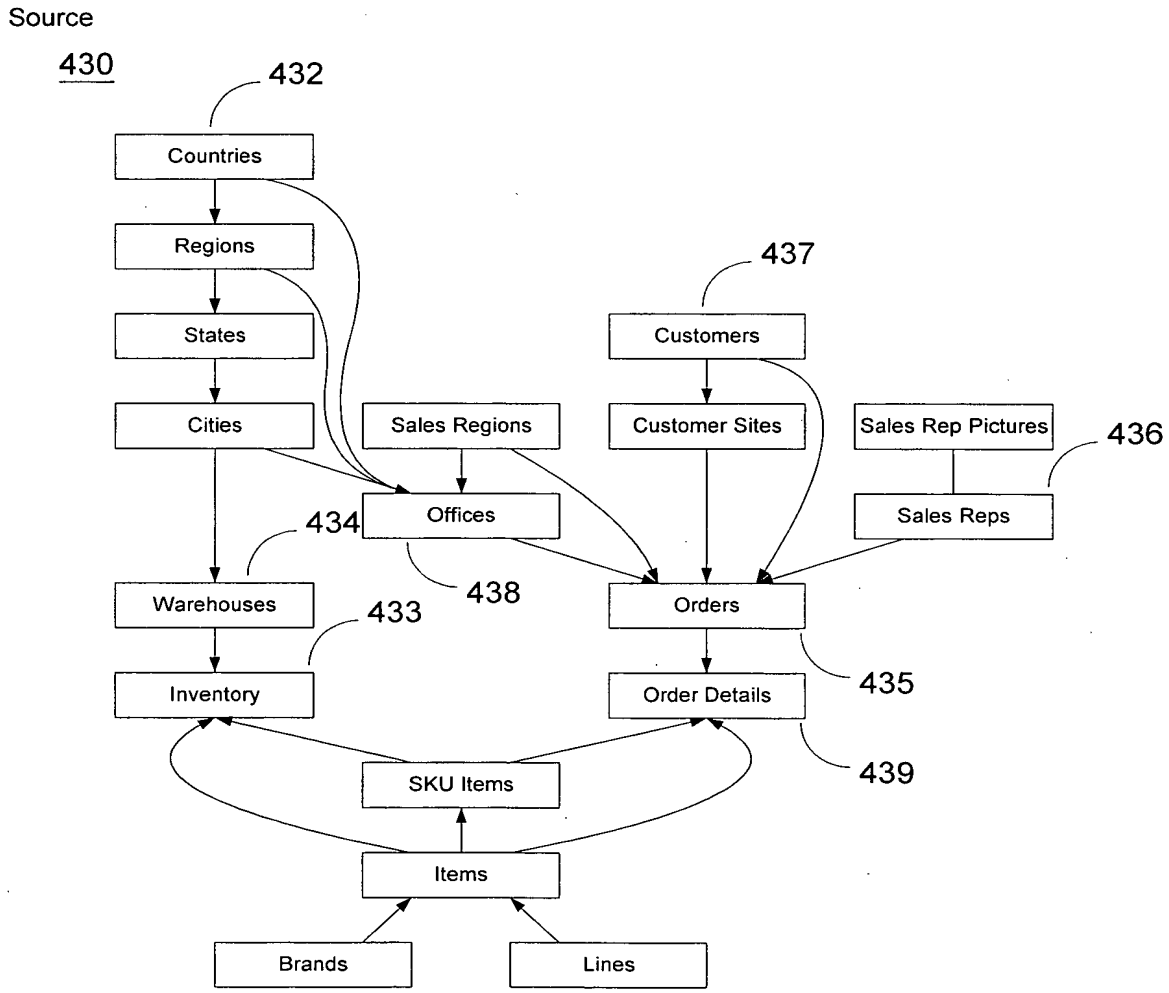

Source
430
432
Countries
Regions
States
Cities
Sales Regions
Offices
434
438
Warehouses
433
Inventory
437
Customers
Customer Sites
Sales Rep Pictures
436
Sales Reps
Orders
435
Order Details
439
SKU Items
Items
Brands
Lines

Fig. 28

Target
440

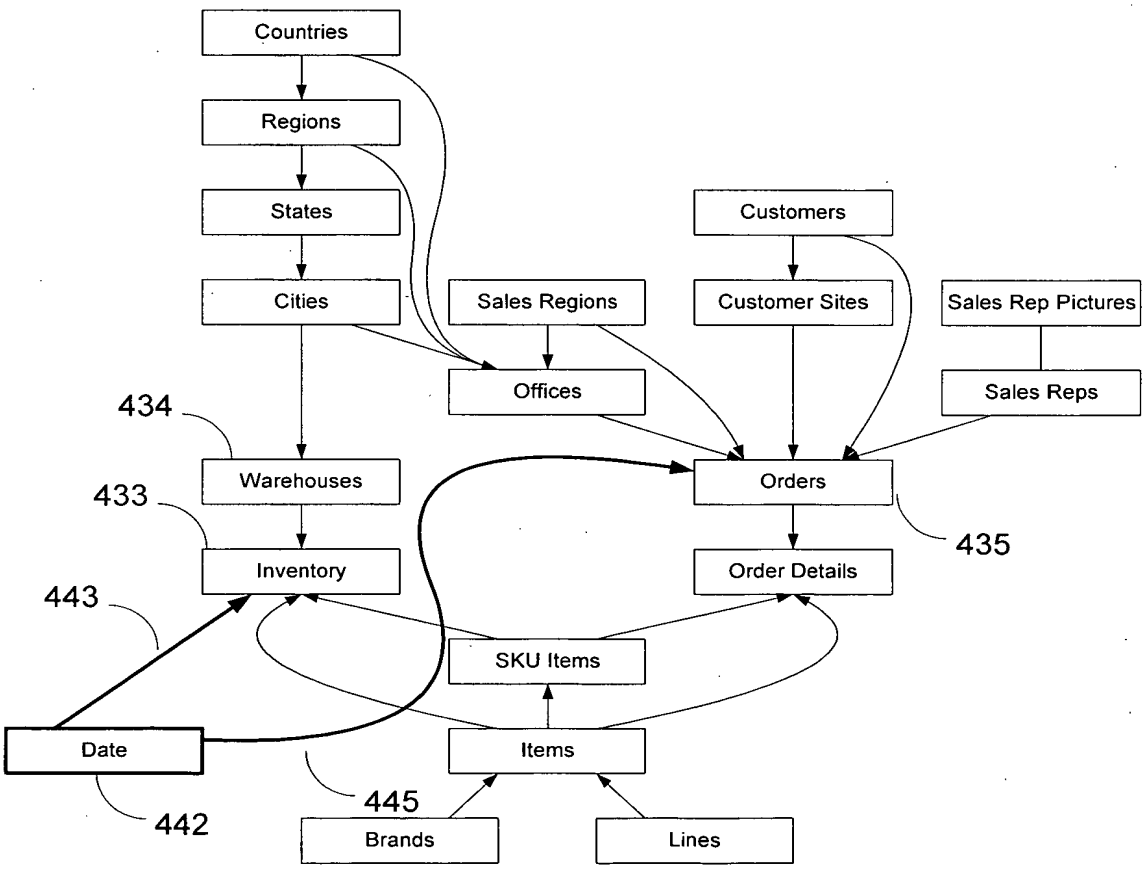


Fig. 29

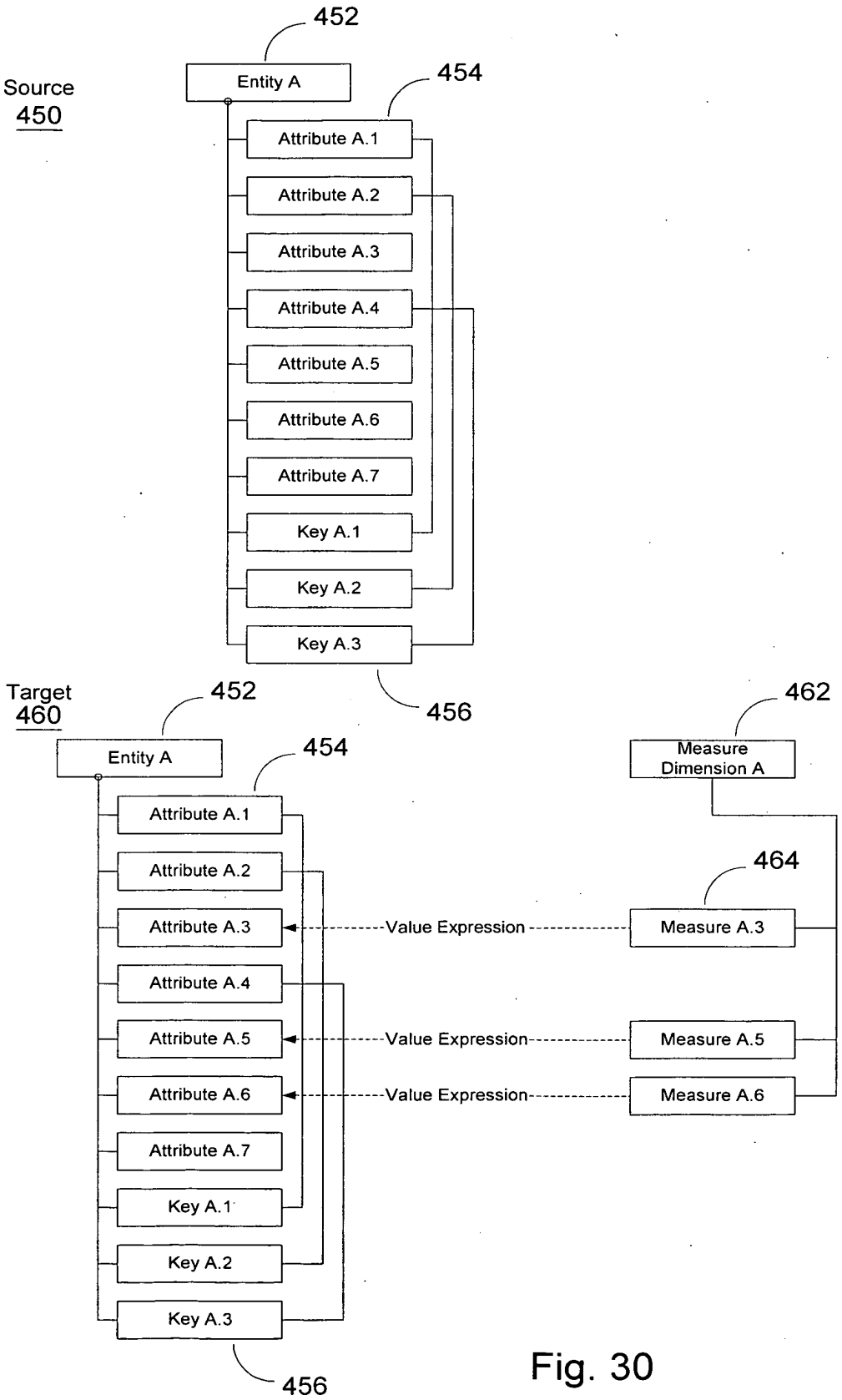

Source
450
452
Entity A
454
Attribute A.1
Attribute A.2
Attribute A.3
Attribute A.4
Attribute A.5
Attribute A.6
Attribute A.7
Key A.1
Key A.2
Key A.3
456
Target
460
452
Entity A
454
Attribute A.1
Attribute A.2
Attribute A.3
Attribute A.4
Attribute A.5
Attribute A.6
Attribute A.7
Key A.1
Key A.2
Key A.3
456
462
Measure Dimension A
464
Measure A.3
Measure A.5
Measure A.6
Value Expression
Value Expression
Value Expression

Fig. 30

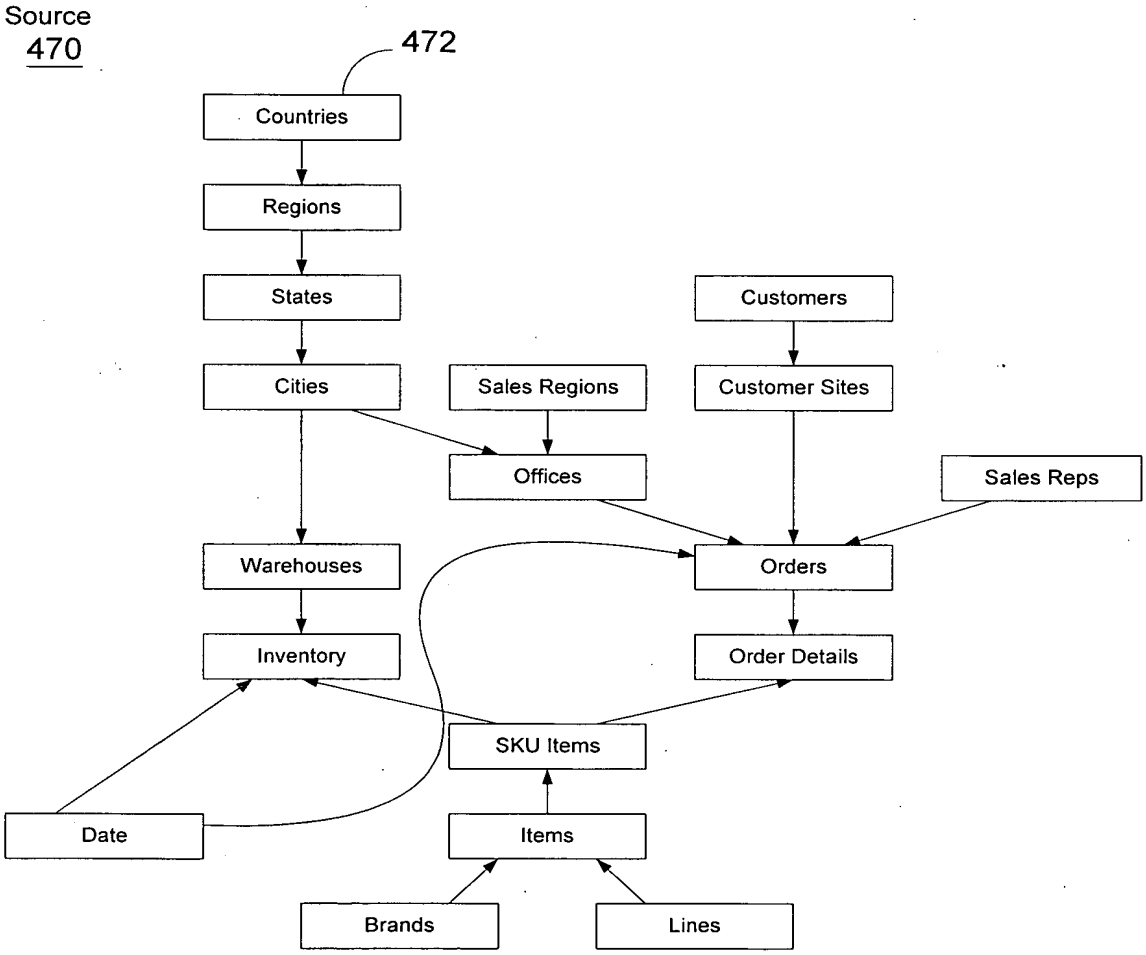

Source
470
472
Countries
Regions
States
Cities
Customers
Sales Regions
Customer Sites
Offices
Sales Reps
Warehouses
Orders
Inventory
Order Details
SKU Items
Date
Items
Brands
Lines

Fig. 31

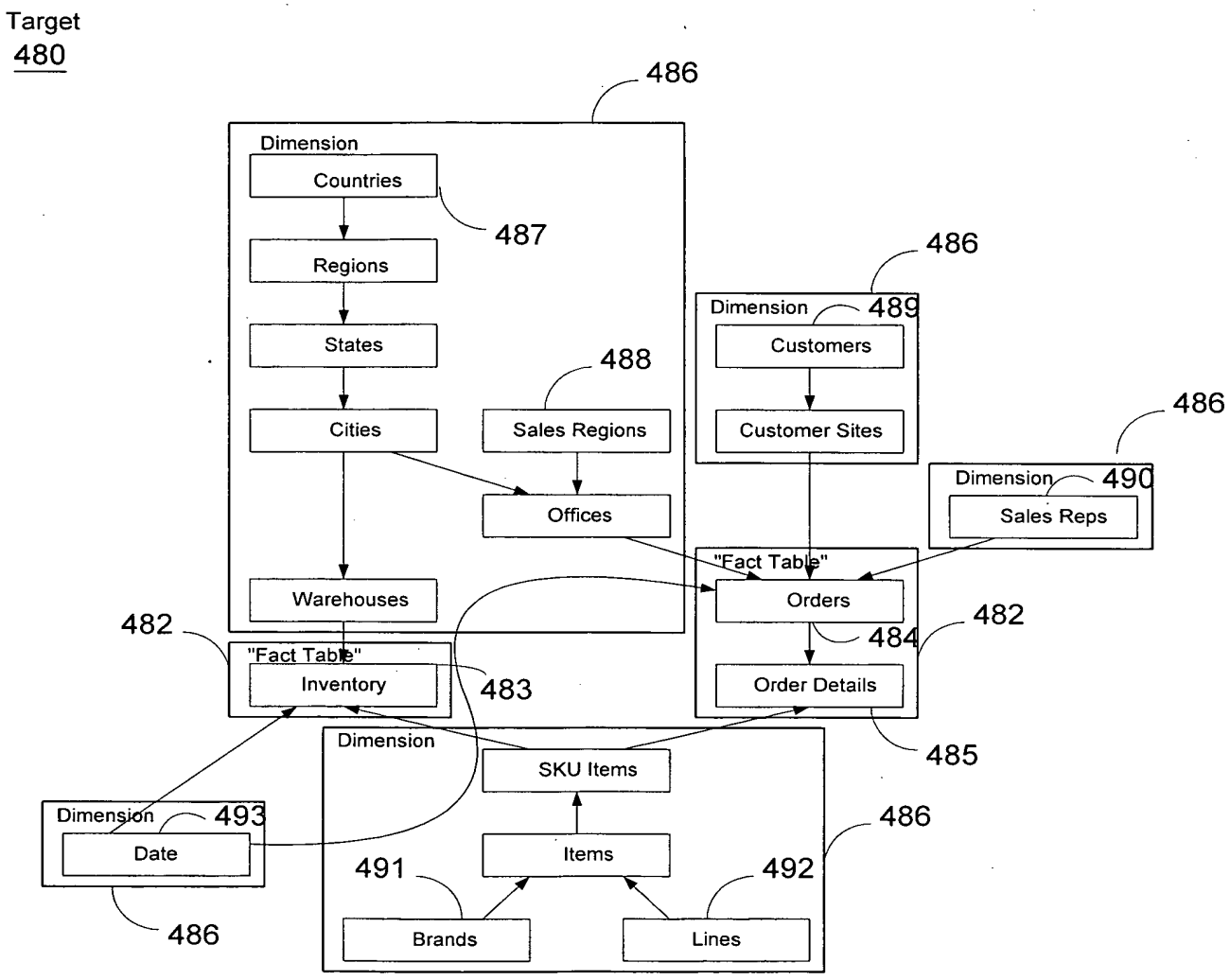

Target
480
486
Dimension
Countries
487
Regions
States
Cities
488
Sales Regions
Offices
Warehouses
482
"Fact Table"
Inventory
483
Dimension
489
Customers
Customer Sites
486
Dimension
490
Sales Reps
"Fact Table"
Orders
484
482
Order Details
485
Dimension
SKU Items
Items
491
492
Brands
Lines
486
Dimension
493
Date
486

Fig. 32

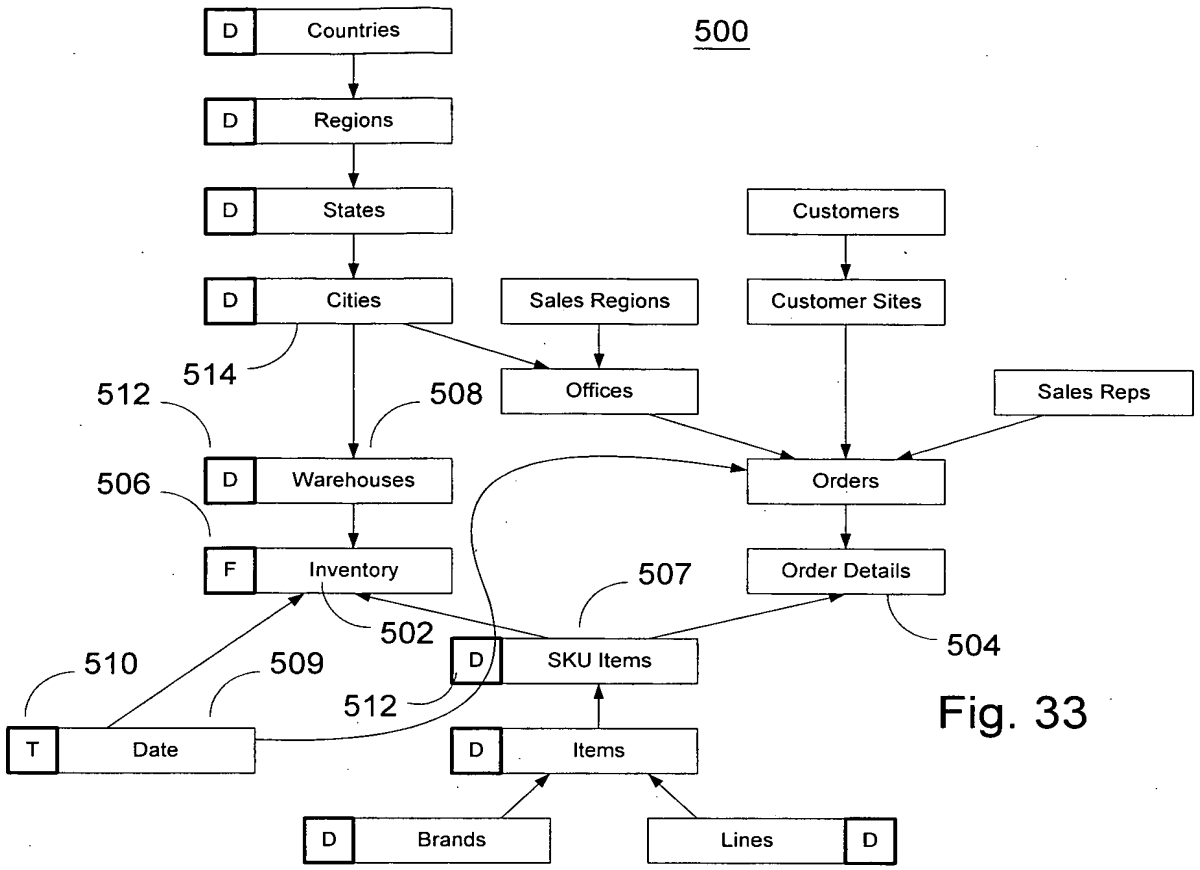

500
D Countries
D Regions
D States
D Cities
Sales Regions
Customers
Customer Sites
Offices
Sales Reps
Warehouses
Orders
F Inventory
Order Details
SKU Items
Date
Items
Brands
Lines
D
T
F
502
504
506
507
508
509
510
512
514

Fig. 33

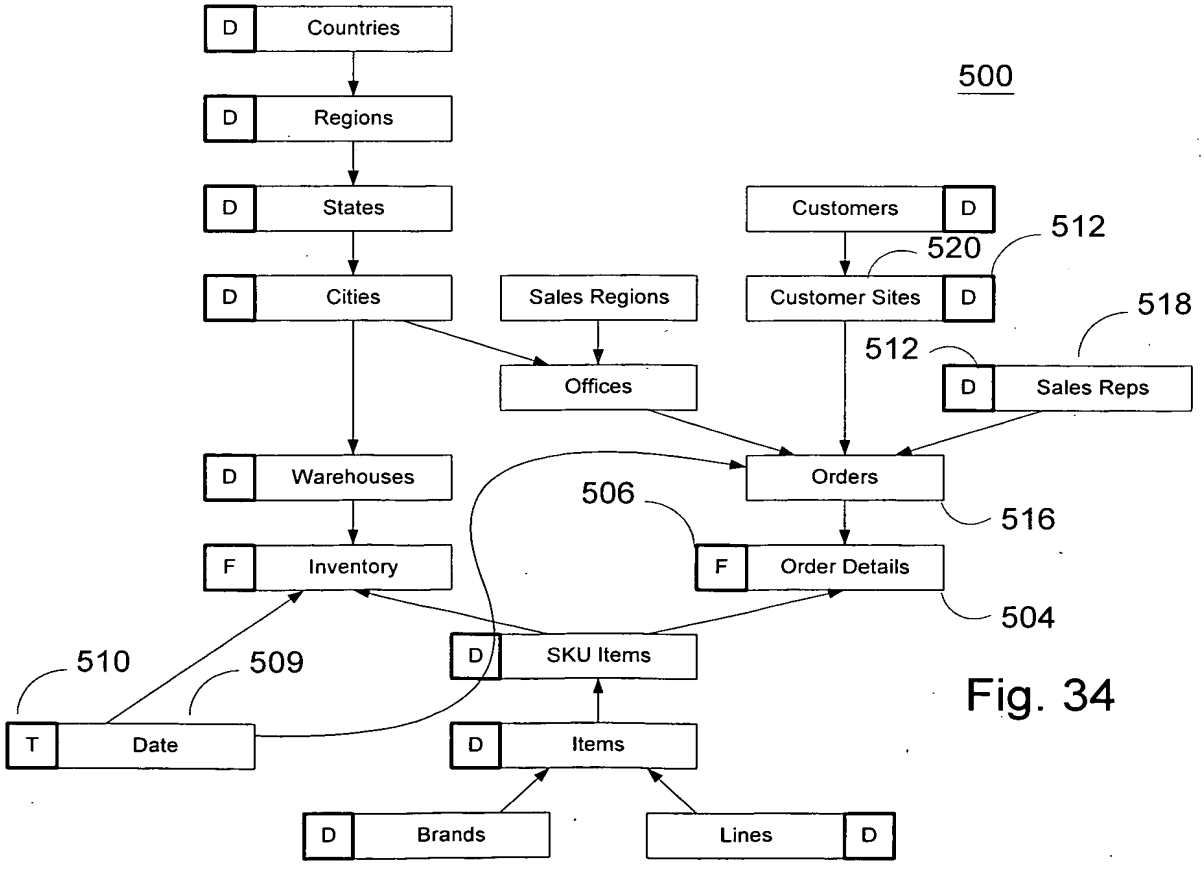

500
D Countries
D Regions
D States
D Cities
Sales Regions
Customers D
Customer Sites D
Offices
D Sales Reps
Warehouses
Orders
F Inventory
F Order Details
D SKU Items
T Date
D Items
D Brands
Lines D
504
506
509
510
512
516
518
520

Fig. 34

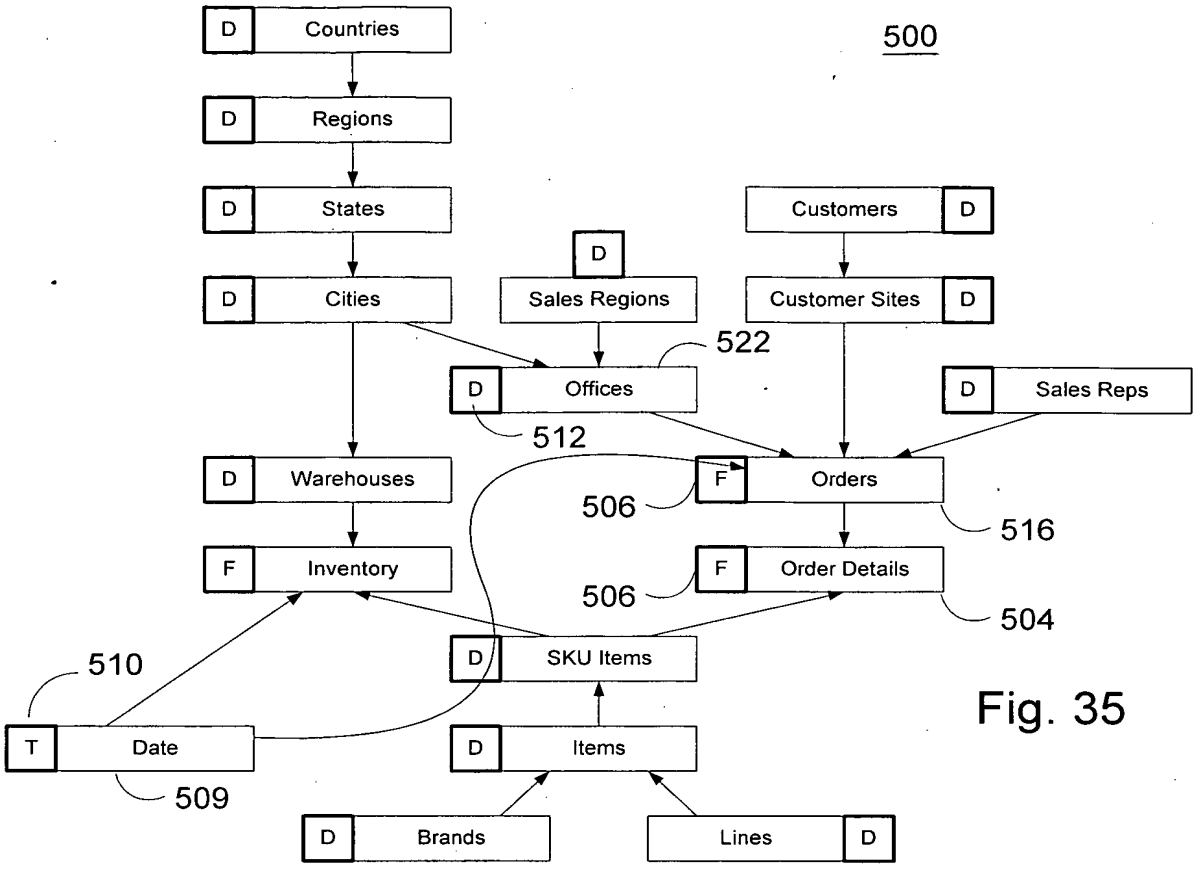

500
D Countries
D Regions
D States
D Cities
D Sales Regions
Customers D
Customer Sites D
522
D Offices
D Sales Reps
512
D Warehouses
F Orders
506
516
F Inventory
F Order Details
506
504
D SKU Items
510
T Date
D Items
509
D Brands
Lines D

Fig. 35

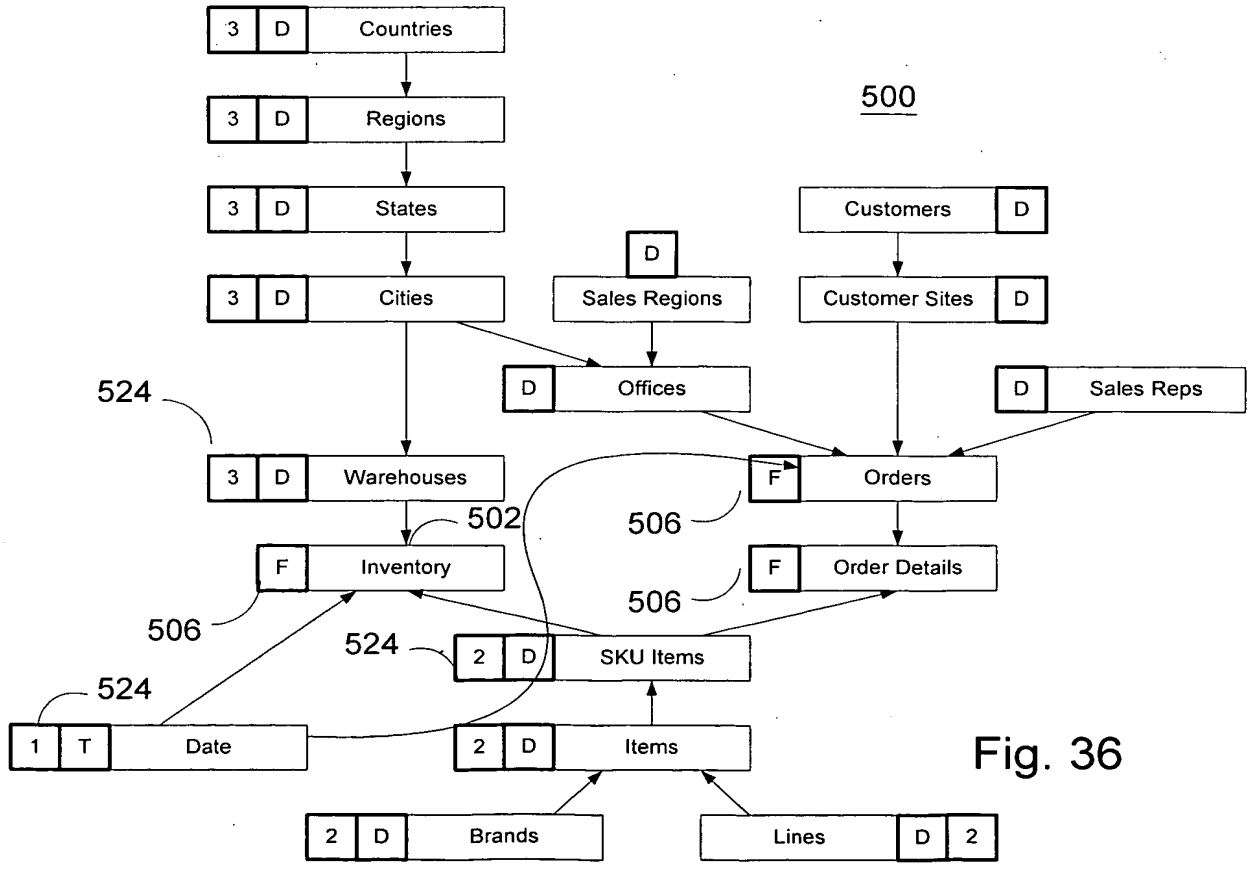

500
3 D Countries
3 D Regions
3 D States
3 D Cities
D Sales Regions
Customers D
Customer Sites D
D Offices
D Sales Reps
524
3 D Warehouses
F Orders
506
502
F Inventory
F Order Details
506
506
524
2 D SKU Items
524
1 T Date
2 D Items
2 D Brands
Lines D 2

Fig. 36

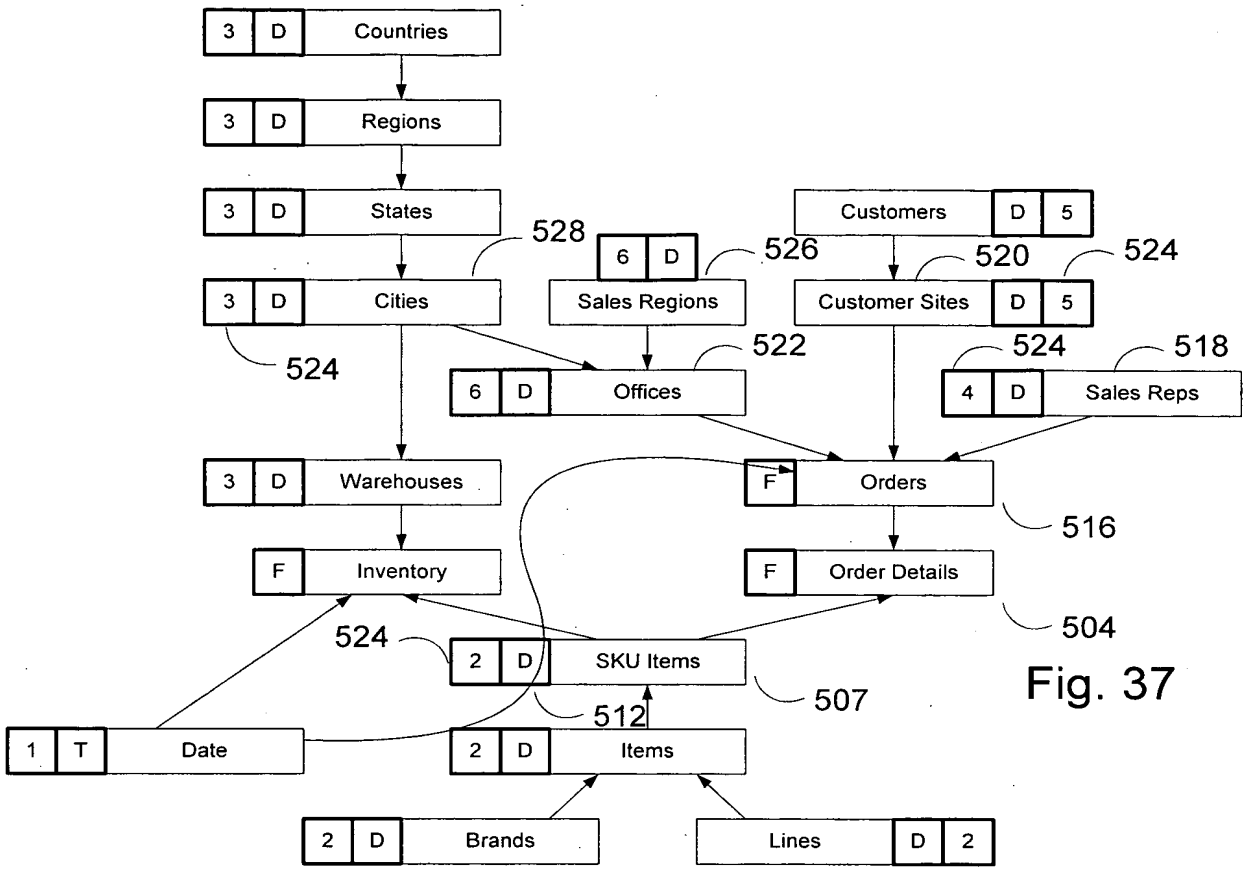

3 D Countries
3 D Regions
3 D States
3 D Cities
524
528
6 D Sales Regions
526
Customers D 5
520
524
Customer Sites D 5
6 D Offices
522
524
4 D Sales Reps
518
3 D Warehouses
F Orders
516
F Inventory
F Order Details
504
524
2 D SKU Items
507
512
1 T Date
2 D Items
2 D Brands
Lines D 2

Fig. 37

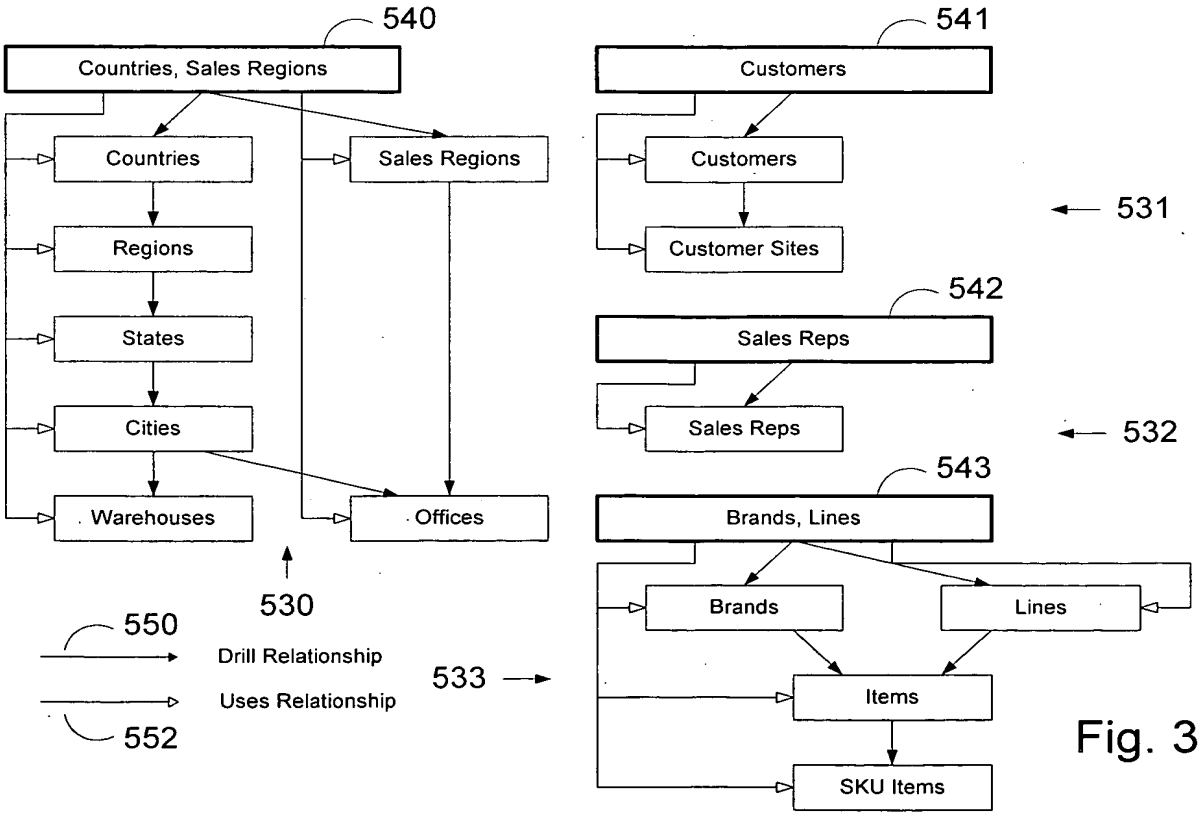

540
Countries, Sales Regions
Countries
Sales Regions
Regions
States
Cities
Warehouses
Offices
530
541
Customers
Customers
Customer Sites
531
542
Sales Reps
Sales Reps
532
543
Brands, Lines
Brands
Lines
Items
SKU Items
533
550
Drill Relationship
Uses Relationship
552

Fig. 38

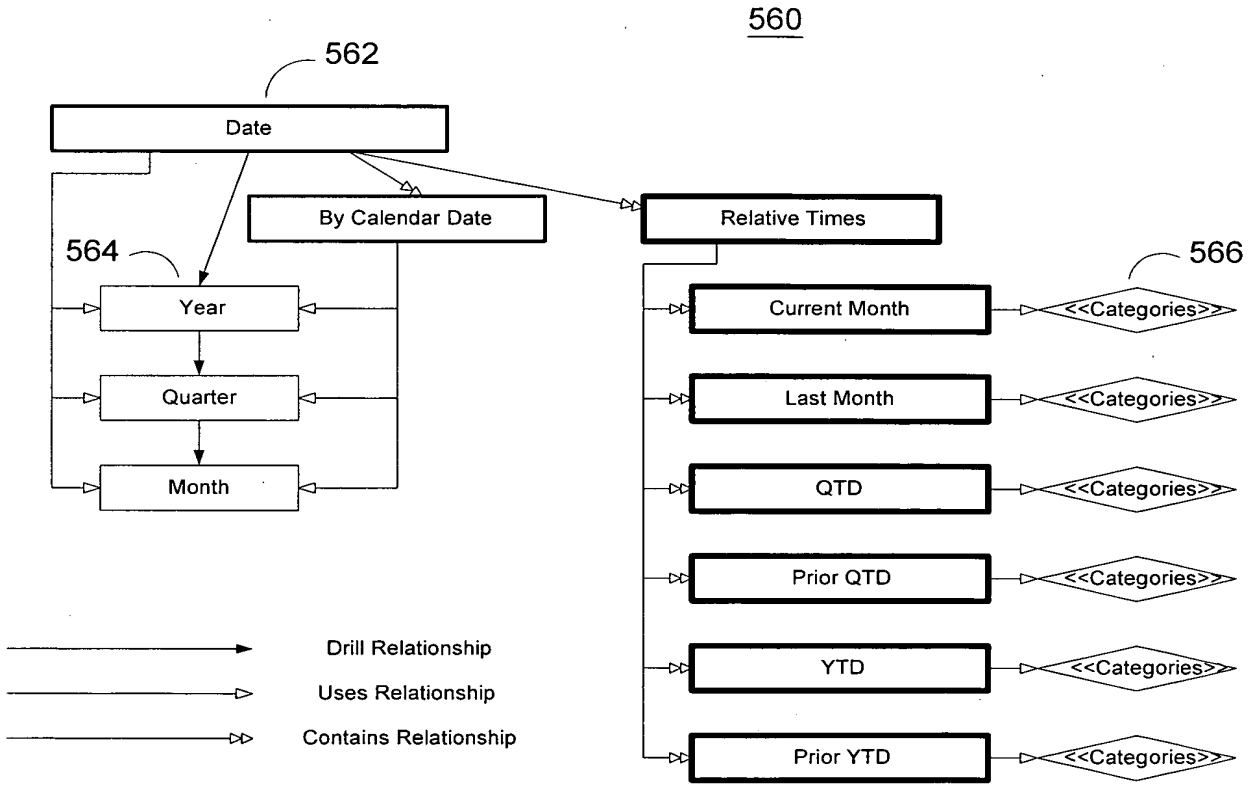
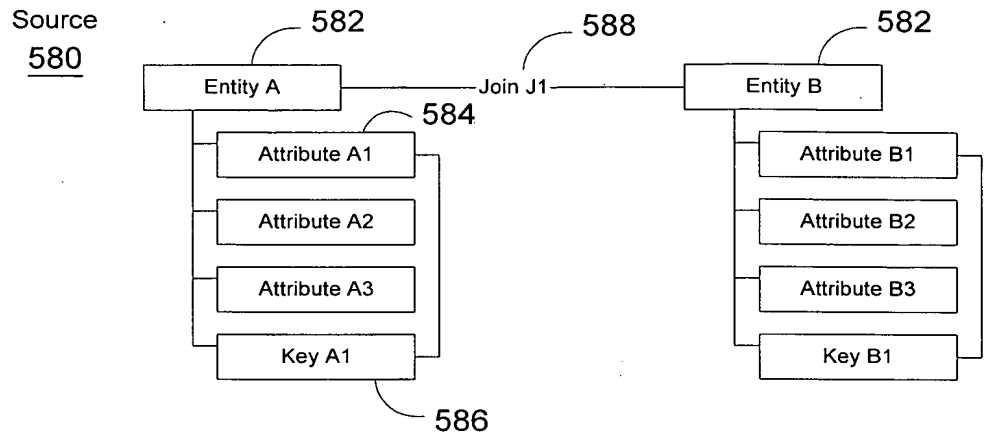

560
562
Date
By Calendar Date
Relative Times
564
566
Year
Quarter
Month
Current Month
Last Month
QTD
Prior QTD
YTD
Prior YTD
<<Categories>>
Drill Relationship
Uses Relationship
Contains Relationship

Figure 39


Source
580
582
588
582
Entity A
Join J1
Entity B
584
Attribute A1
Attribute A2
Attribute A3
Key A1
Attribute B1
Attribute B2
Attribute B3
Key B1
586

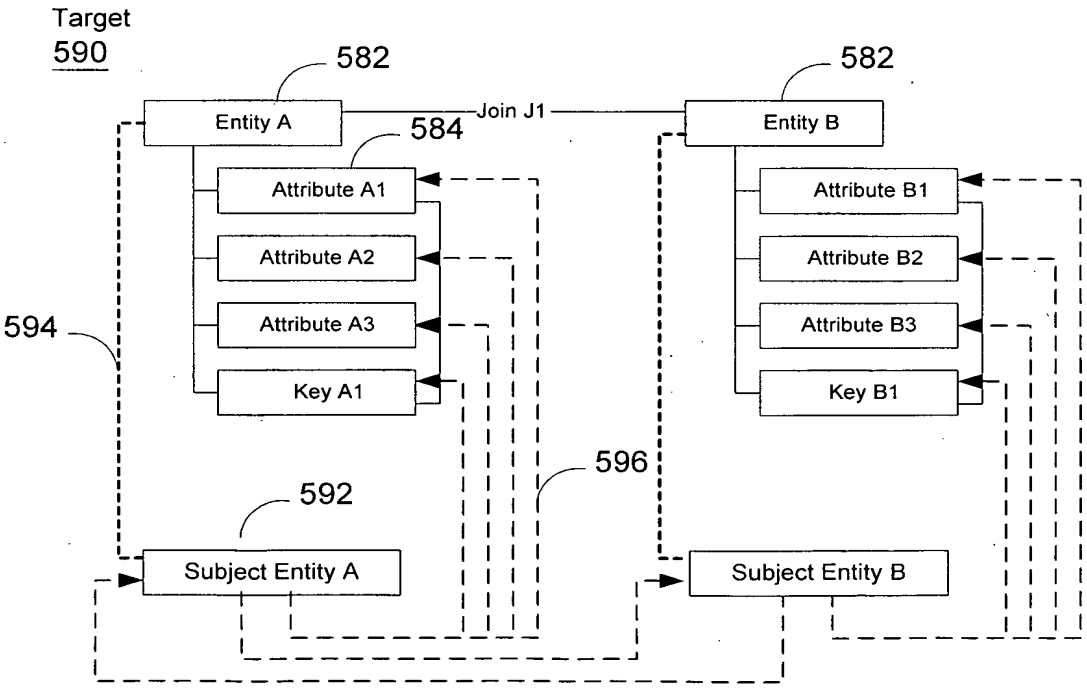
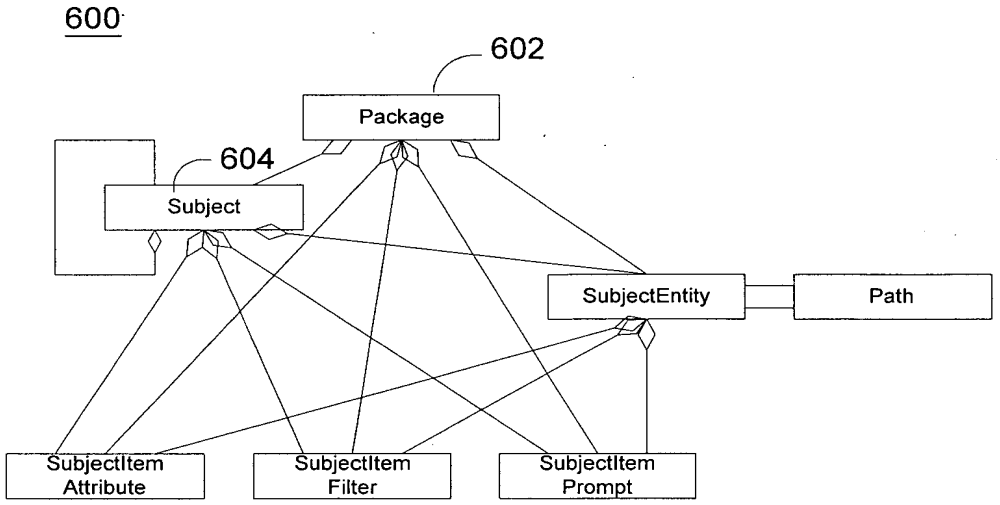

Target
590
582
582
Entity A
Join J1
Entity B
584
Attribute A1
Attribute A2
Attribute A3
Key A1
Attribute B1
Attribute B2
Attribute B3
Key B1
594
596
592
Subject Entity A
Subject Entity B

Fig. 40


600
602
Package
604
Subject
SubjectEntity
Path
SubjectItem Attribute
SubjectItem Filter
SubjectItem Prompt

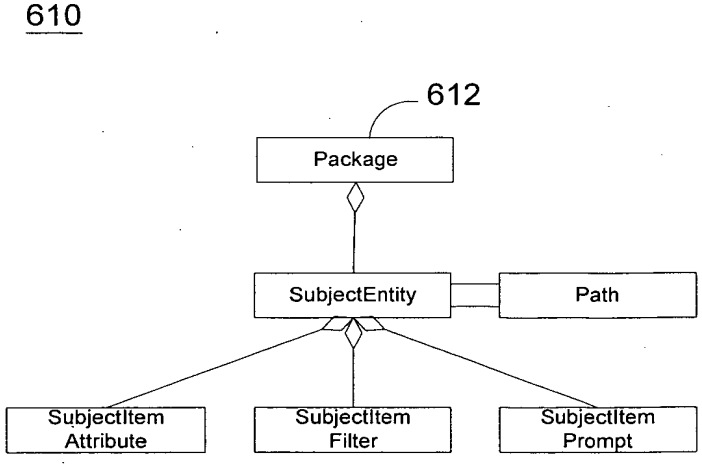

610
612
Package
SubjectEntity
Path
SubjectItem Attribute
SubjectItem Filter
SubjectItem Prompt

Fig. 41